



P.O. BOX 1077
PRICE, UTAH 84501
PHONE: (435) 564-4000
FAX: (435) 564-4002

April 4, 2002

Utah Coal Program
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, UT 84114-5801

Dear Sirs,

Re: Annual Report, Crandall Cyn Mine, C015/032

GENWAL Resources, Inc. is submitting 2 copies of the Annual Report.

Call me at 435-564-4015 if you have any questions.

Sincerely

Gary E. Gray
Engineer

RECEIVED

APR 05 2002

DIVISION OF
OIL, GAS AND MINING

GENERAL INFORMATION

Permittee Name	Genwal Resources, Inc.
Mine Name	Crandall Canyon
Operator Name (If other than permittee)	same
Permit Expiration Date	May 13, 2003
Permit Number	C/015/032
Authorized Representative Title	Gary E. Gray
Phone Number	435-564-4015
Fax Number	435-564-4002
E-mail Address	ggray@andalex.com
Mailing Address	P.O. Box 1077 Price, UT 84501
Resident Agent	Gary E. Gray
Resident Agent Mailing Address	P.O. Box 1077 Price, UT 84501
Number of Binders Submitted	2

IDENTIFICATION OF OTHER PERMITS

Identify other permits that are required in conjunction with mining and reclamation activities.

Permit Type	ID Number	Description	Expiration Date
MSHA Mine ID(s)	42-01715	Underground Coal Mine	N/A
MSHA Impoundment(s)	N/A		
NPDES/UPDES Permit(s)	UT0024368		08/31/2005
PSD Permit(s) (Air)	DAQE798-97		N/A
Other			

CERTIFIED REPORTS

Certified Reports:	Required		Included or on file with DOGM		Comments
	Yes	No	Included	On File	
Excess Spoil Piles	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	
Refuse Piles	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	
Impoundments	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	
Other					
Sediment Pond	X	<input type="checkbox"/>	X	<input type="checkbox"/>	Annual
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

REPORTING OF OTHER TECHNICAL DATA

List other technical data and information as required under the approved plan, which must be periodically submitted to the Division. Specify whether the information is included as Appendix B to this report or currently on file with the Division.

Technical Data:	Required		Included or on file with DOGM		Comments
	Yes	No	Included	On file	
Climatological	X	<input type="checkbox"/>	X	<input type="checkbox"/>	
Subsidence Monitoring	X	<input type="checkbox"/>	X	<input type="checkbox"/>	
Vegetation Monitoring	X	<input type="checkbox"/>	X	<input type="checkbox"/>	
Raptor Survey	X	<input type="checkbox"/>	X	<input type="checkbox"/>	
Soils Monitoring	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	
Water Monitoring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
First quarter	X	<input type="checkbox"/>	<input type="checkbox"/>	X	
Second quarter	X	<input type="checkbox"/>	<input type="checkbox"/>	X	
Third quarter	X	<input type="checkbox"/>	<input type="checkbox"/>	X	
Fourth quarter	X	<input type="checkbox"/>	<input type="checkbox"/>	X	
Geological / Geophysical	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	
Engineering	<input type="checkbox"/>	X	<input type="checkbox"/>	<input type="checkbox"/>	
Other Data					
Abandoned U'grd Eqpt	X	<input type="checkbox"/>	X	<input type="checkbox"/>	None Abandoned
Water Monitoring Data Analysis	X	<input type="checkbox"/>	X	<input type="checkbox"/>	Report by Eric Petersen
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

Legal / Financial Update	Required		Included or on File with DOGM		Comments
	Yes	No	Included	On file	
Department of Commerce, Annual Report Officers	X	<input type="checkbox"/>	X	<input type="checkbox"/>	
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

MINE MAPS

OTHER INFORMATION

Additional attachment to this report?

Yes

No X

APPENDIX A

Certified Reports

As required under R645-301-514

CONTENTS

Annual Pond Inspection

SEDIMENT POND INSPECTION AND CERTIFIED REPORT			Page 1 of 3
Permit Number	ACT/015/032	Report Date	12/27/01
Mine Name	Crandall Canyon Mine		
Company Name	Genwal Resources Inc.		
Sediment Pond Identification	Sediment Pond Name	Genwal Sediment Pond No. 1	
	UPDES Permit Number	UT0024368	
SEDIMENT POND INSPECTION			
Inspection Date	12/05/01		
Inspected By	John C. Lewis & Gary E. Gray		
Reason for Inspection (Annual, Quarterly or Other Periodic Inspection, Critical Installation, or Completion of Construction)	Annual		
<p>1. Describe any appearance of any instability, structural weakness, or any other hazardous condition.</p> <p>None Observed</p>			
Required for an impoundment which functions as a SEDIMENTATION POND.	<p>2. Sediment storage capacity, including elevation of 60% and 100% sediment storage volumes, and, estimated average elevation of existing sediment.</p> <p>Total sediment storage capacity = 0.4834 acre feet.</p> <p>60% sediment storage volume elevation = 7894.00 feet.</p> <p>100% storage volume elevation = 7895.00 feet.</p> <p>Existing average elevation of sediment = 7893.00 feet.</p>		
	<p>3. Principal and emergency spillway elevations.</p> <p>Principal spillway elevation = 7905.81 feet.</p> <p>Emergency spillway elevation = 7906.81 feet.</p>		

4. **Field Information.** Provide current water elevation, whether pond is discharging, type and number of samples taken, monitoring/instrumentation information, inlet/outlet conditions, or other related activities associated with the pond including but not limited to sediment cleanout, pond decanting, embankment erosion/repairs, monitoring information, vegetation on outslopes of embankments, etc.

Water elevation = 7899 feet.

Pond discharge = no discharge.

Samples = no discharge/none taken.

Inlet condition = no observable problems.

Outlet condition = no observable problems.

Embankment show no signs of erosion, instability or hazardous conditions.

5. **Field Evaluation.** Describe any changes in the geometry of the impounding structure, average and maximum depths and elevations of impounded water, estimated sediment or slurry volume and remaining storage capacity, estimated volume of water impounded, and any other aspect of the impounding structure affecting its stability or function which has occurred during the reporting period.

Pond is frozen and covered with snow impounding approximately 1.45 acre feet of water and 0.25 acre feet of sediment. Remaining sediment storage capacity is approximately 0.075 acre feet to cleanout level. No observable conditions were apparent that could affect the stability or function of the structure.

Qualification Statement



I hereby certify that; this sediment pond was constructed under the direction of a Registered Professional Engineer that was experienced in the construction/design of impoundments. I am qualified and authorized to inspect the condition and appearance of impoundments/sediment ponds in accordance with the certified and approved designs for this structure; that the impoundment/sediment pond has been maintained in accordance with approved design and meet or exceed the minimum design requirements under all applicable federal, state and local regulations; and, that inspections and inspection reports are made by myself or under my direction and include any appearances of instability, structural weakness or other hazardous conditions of the structure affecting stability.

Signature: J. C. Lewis Date: 1/2/02

CERTIFIED REPORT

SEDIMENT POND EVALUATION (If NO, explain under Comments)	YES	NO
1. Is sediment pond designed and constructed in accordance with the approved plan?	X	
2. Is sediment pond free of instability, structural weakness, or any other hazardous condition?	X	
3. Has the sediment pond met all applicable performance standards and effluent limitations from the previous date of inspection?	X	

COMMENTS AND OTHER INFORMATION**Certification Statement:**

I hereby certify that; this sediment pond was constructed under the direction of a Registered Professional Engineer that was experienced in the construction/design of impoundments. I am qualified and authorized in the State of Utah to inspect and certify the condition and appearance of impoundments/sediment ponds in accordance with the certified and approved designs for this structure; that the impoundment/sediment pond has been maintained in accordance with approved design and meet or exceed the minimum design requirements under all applicable federal, state and local regulations; and, that inspections and inspection reports are made by myself or under my direction and include any appearances of instability, structural weakness or other hazardous conditions of the structure affecting stability in accordance with the Utah R645 Coal Mining Rules.

By: John C. Lewis Mining Engineer
 (Full Name and Title)

Signature: John C. Lewis Date: 1/2/02

P.E. Number & State: 191488 Utah

APPENDIX B

Reporting of Technical Data

Including monitoring data, reports, maps, and other information
As required under the approved plan or as required by the Division

In accordance with the requirement of R645-310-130 and R645-301-140

CONTENTS

Precipitation Log

Subsidence Data

Abandoned Equipment

Water Data Analysis

Vegetation Monitoring

Raptor Survey

PRECIPITATION LOG

DATE	MEASUREMENT	SOURCE	INITIALS
1-12-01	.6"	Snow	SW
1-13-01	1.5"	Snow	SW
1-15-01	Trace	Snow	SW
1-19-01	1"	Snow	SW
1-25-01	5"	Snow	SW
1-27-01	6.5"	Snow	SW
2-6-01	1.5"	Snow	SW
2-10-01	.1"	Snow	SW
2-11-01	.5"	Snow	SW
2-12-01	.1"	Snow	SW
2-14-01	SKIFF	Snow	SW
2-17-01	1.5"	Snow	SW
2-21-01	5"	Snow	SW
2-23-01	9"	Snow	SW
2-26-01	2"	Snow	SW
2-27-01	SKIFF	Snow	SW
2-28-01	7.5"	Snow	SW
3-3-01	4"	Snow	SW
3-6-01	SKIFF	Snow	SW
3-8-01	2"	Snow	SW
3-11-01	6"	Snow	SW
3-15-01	Trace	Rain	SW
3-19-01	2"	Snow	SW
3-20-01	3.5"	Snow	SW
3-30-01	.5"	Rain	SW
3-31-01	5"	Snow	SW
4-4-01	2"	Snow	SW
4-5-01	SKIFF	Snow	SW
4-8-01	6.5"	Snow	SW
4-9-01	7"	Snow	SW
4-12-01	7"	Snow	SW
4-21-01	5.5"	Snow	SW
4-22-01	2"	Snow	SW
5-2-01	4"	Snow	SW
5-3-01	9"	Snow	SW
5-4-01	6"	Snow	SW
5-13-01	.10	Rain	SW
5-16-01	.15	Rain	SW
5-17-01	.18	Rain	SW

Personnel change made - replacement forgot to do record.
is now recording data 3/20/02

Subsidence

The subsidence of the surface at Genwal due to longwall mining has been monitored annually by photogrammetric methods for many years. Longwall mining commenced in 1995, and has continuously operated since then. The practice of longwall mining at Genwal is somewhat different than at other mines in Utah. The current mining area is the only large area that has been mined out in one block at Genwal. Previous longwall mined areas are small. This considerably reduces the amount of surface subsidence over the mined areas. Also Genwal only mines one seam. Keeping these differences in mind, the amount of subsidence at Genwal is somewhat less than at other mines.

The subsidence monitoring program covers 2120 points on the surface over the entire permit area. Many of these are over areas which have not had any mining. In fact 1335 points have no movement, and 1902 points have less than 1 foot movement. Only 218 points have movement from 1 foot to 6 foot range. The maximum is 6.9 feet. The average of the 218 points is 2.6 feet.

Olympus Aerial Surveys, Inc.
Job No 201093
Report for October 15, 2001 (1995 Study Year)
For
GENWAL RESOURCES, INC.
CRANDALL CANYON (ALL) SUBSIDENCE STUDY

POINT	EASTING	NORTHING	1995		2001	POINT	COMMENTS
			STUDY ELEVATION	2001 DIFFERENCE	BASE ELEVATION		
100	2075554.641	416511.777	9212.85	0.32	9213.17	100	
101	2075558.238	407296.622	8866.90	-0.34	8866.56	101	
102	2075571.465	408179.127	8882.61	-0.74	8881.87	102	
103	2075578.997	408784.976	8879.63	-0.73	8878.90	103	
104	2075579.333	407874.899	8881.62	-0.14	8881.48	104	
105	2075580.158	408490.497	8877.21	-0.32	8876.89	105	
106	2075584.099	407579.859	8881.37	-0.08	8881.29	106	
107	2075586.078	418626.301	9195.19	2.99	9198.18	107	
108	2075589.924	409081.631	8881.00	-0.87	8880.13	108	
109	2075591.674	409392.750	8884.13	-0.30	8883.83	109	
110	2075596.374	409675.980	8888.45	-0.18	8888.27	110	
111	2075602.098	414772.964	9082.30	0.02	9082.32	111	
112	2075602.211	411777.074	8941.29	-0.42	8940.87	112	
113	2075602.655	415732.602	9178.12	0.05	9178.17	113	
114	2075603.148	410302.698	8898.94	0.20	8899.14	114	
115	2075604.359	410889.582	8914.47	-0.06	8914.41	115	
116	2075605.536	409968.624	8891.86	-0.24	8891.62	116	
117	2075608.931	413586.436	9033.89	0.03	9033.92	117	
118	2075610.583	414195.043	9058.74	0.14	9058.88	118	
119	2075611.545	413292.485	9013.96	0.08	9014.04	119	
120	2075611.700	415061.373	9129.82	0.01	9129.83	120	
121	2075613.550	411501.717	8929.53	-0.27	8929.26	121	
122	2075614.250	412976.268	8993.28	0.04	8993.32	122	
123	2075615.021	413902.429	9047.83	-0.01	9047.82	123	
124	2075615.076	411181.655	8921.24	0.08	8921.32	124	
125	2075617.063	414458.204	9069.70	0.05	9069.75	125	
126	2075620.148	410574.465	8906.98	-0.86	8906.12	126	
127	2075620.503	415393.849	9155.56	0.07	9155.63	127	
128	2075623.045	416861.260	9205.82	0.22	9206.04	128	
129	2075623.955	412393.829	8967.41	-0.32	8967.09	129	
130	2075627.162	412688.260	8980.62	0.00	8980.62	130	
131	2075627.238	412092.665	8955.58	-0.06	8955.52	131	
132	2075634.137	416269.565	9199.78	0.32	9200.10	132	
133	2075636.346	417167.610	9205.14	0.22	9205.36	133	
134	2075637.108	415992.834	9182.23	0.09	9182.32	134	
135	2075663.742	417472.573	9210.77	0.85	9211.62	135	
136	2075677.553	417785.304	9253.22	0.18	9253.40	136	
137	2075734.834	418090.100	9274.08	0.19	9274.27	137	
138	2075857.818	407000.991	8867.15	0.02	8867.17	138	
139	2075861.849	407297.283	8888.57	0.12	8888.69	139	
140	2075869.383	407593.316	8903.04	-0.62	8902.42	140	
141	2075879.730	408201.675	8899.25	0.01	8899.26	141	
142	2075880.579	408499.528	8899.35	-0.36	8898.99	142	

POINT	EASTING	NORTHING	1995	2001	2001	POINT	COMMENTS
			STUDY ELEVATION	2001 DIFFERENCE	BASE ELEVATION		
143	2075883.995	407920.020	8902.36	-0.60	8901.76	143	
144	2075884.063	408798.754	8898.63	-0.37	8898.26	144	
145	2075885.406	409081.868	8896.74	-0.03	8896.71	145	
146	2075893.830	409396.582	8898.88	0.22	8899.10	146	
147	2075896.091	410302.768	8915.15	0.30	8915.45	147	
148	2075897.230	409710.735	8900.68	-0.23	8900.45	148	
149	2075898.176	412098.850	8970.73	0.06	8970.79	149	
150	2075898.281	410002.259	8908.48	-0.35	8908.13	150	
151	2075902.609	410607.540	8922.88	-0.10	8922.78	151	
152	2075904.932	412441.995	8985.20	0.35	8985.55	152	
153	2075906.072	410887.885	8925.99	-0.51	8925.48	153	
154	2075906.537	411800.967	8956.88	0.92	8957.80	154	
155	2075910.837	418399.827	9242.53	2.32	9244.85	155	
156	2075911.693	411495.359	8942.26	0.00	8942.26	156	
157	2075912.006	413905.206	9066.51	-0.69	9065.82	157	
158	2075912.428	411193.224	8930.95	0.20	8931.15	158	
159	2075915.948	413323.991	9026.89	0.31	9027.20	159	
160	2075933.340	413606.072	9047.75	0.20	9047.95	160	
161	2075938.729	414507.997	9095.29	0.54	9095.83	161	
162	2075939.680	414222.310	9083.73	-0.01	9083.72	162	
163	2075942.065	415713.505	9146.80	-0.19	9146.61	163	
164	2075942.534	413029.330	9013.39	0.18	9013.57	164	
165	2075945.266	414807.484	9103.55	0.42	9103.97	165	
166	2075947.425	415134.430	9115.55	0.72	9116.27	166	
167	2075954.765	412717.969	9002.49	0.18	9002.67	167	
168	2075955.869	417208.168	9189.41	1.89	9191.30	168	
169	2075956.113	417810.485	9200.46	1.99	9202.45	169	
170	2075956.728	416910.527	9179.40	1.31	9180.71	170	
171	2075957.722	415984.402	9156.04	0.02	9156.06	171	
172	2075958.399	418668.301	9247.89	3.55	9251.44	172	
173	2075968.471	417509.313	9194.98	1.74	9196.72	173	
174	2075973.226	416323.895	9165.45	0.18	9165.63	174	
175	2075981.539	415451.954	9131.73	0.95	9132.68	175	
176	2075983.887	416621.690	9171.62	1.41	9173.03	176	
177	2076067.139	418133.417	9212.56	1.78	9214.34	177	
178	2076123.601	407301.758	8906.33	-0.55	8905.78	178	
179	2076143.864	406996.867	8886.90	-0.52	8886.38	179	
180	2076166.639	409403.072	8914.31	0.26	8914.57	180	
181	2076171.627	408780.167	8924.00	0.59	8924.59	181	
182	2076172.344	407544.094	8930.30	-0.50	8929.80	182	
183	2076174.313	409683.486	8917.26	0.93	8918.19	183	
184	2076176.336	408177.474	8925.77	-0.44	8925.33	184	
185	2076176.580	408478.025	8925.46	1.37	8926.83	185	
186	2076177.726	407868.195	8929.49	-1.27	8928.22	186	
187	2076181.962	410281.182	8934.80	0.44	8935.24	187	
188	2076185.412	412091.495	8987.68	0.12	8987.80	188	
189	2076190.457	411783.904	8972.68	0.54	8973.22	189	
190	2076194.002	409075.426	8922.20	0.08	8922.28	190	
191	2076198.263	410570.224	8943.75	0.74	8944.49	191	
192	2076201.427	409990.000	8929.49	-0.31	8929.18	192	

POINT	EASTING	NORTHING	1995 STUDY ELEVATION	1995 STUDY ELEVATION	2001 DIFFERENCE	2001 BASE ELEVATION	POINT	COMMENTS
				2001 ELEVATION		2001 BASE ELEVATION		
193	2076201.878	410885.555	8945.05	0.75		8945.80	193	
194	2076204.946	413244.617	9035.14	0.08		9035.22	194	
195	2076205.167	411490.288	8960.76	-0.69		8960.07	195	
196	2076205.965	412448.066	9005.19	0.58		9005.77	196	
197	2076206.827	411186.757	8948.28	0.53		8948.81	197	
198	2076226.082	413551.360	9055.04	-0.09		9054.95	198	
199	2076228.595	412705.758	9016.91	0.07		9016.98	199	
200	2076229.897	414462.602	9111.92	0.44		9112.36	200	
201	2076235.431	414188.758	9103.55	0.54		9104.09	201	
202	2076236.310	412970.285	9025.52	-0.02		9025.50	202	
203	2076237.532	414780.117	9119.40	0.15		9119.55	203	
204	2076238.604	413882.576	9081.17	-0.18		9080.99	204	
205	2076247.454	416232.280	9182.70	0.98		9183.68	205	
206	2076249.132	416577.279	9194.98	0.53		9195.51	206	
207	2076252.094	415078.387	9130.78	0.69		9131.47	207	
208	2076252.842	417146.065	9208.53	1.11		9209.64	208	
209	2076252.914	417442.718	9214.97	2.04		9217.01	209	
210	2076253.992	416855.517	9202.81	0.63		9203.44	210	
211	2076257.427	415677.187	9160.75	0.79		9161.54	211	
212	2076259.402	418651.115	9276.19	2.35		9278.54	212	
213	2076260.496	417768.501	9217.89	1.81		9219.70	213	
214	2076260.998	415927.983	9170.31	0.71		9171.02	214	
215	2076263.282	415352.524	9144.99	0.54		9145.53	215	
216	2076272.090	418064.967	9216.13	2.64		9218.77	216	
217	2076282.160	418386.545	9226.86	1.42		9228.28	217	
218	2076463.615	407329.270	8941.36	-0.15		8941.21	218	
219	2076470.880	407602.300	8958.93	-0.44		8958.49	219	
220	2076474.709	407901.090	8956.79	0.08		8956.87	220	
221	2076480.924	408194.773	8951.45	0.18		8951.63	221	
222	2076482.280	408825.347	8952.41	0.37		8952.78	222	
223	2076482.719	408480.438	8955.23	-0.71		8954.52	223	
224	2076483.271	409103.248	8943.96	0.18		8944.14	224	
225	2076489.002	410030.646	8961.75	-0.02		8961.73	225	
226	2076494.160	410319.213	8971.16	-0.10		8971.06	226	
227	2076495.764	409760.219	8946.39	0.57		8946.96	227	
228	2076498.271	410594.890	8977.15	0.16		8977.31	228	
229	2076500.874	409412.088	8937.69	0.94		8938.63	229	
230	2076506.936	411202.998	8975.91	0.40		8976.31	230	
231	2076509.185	411805.286	9001.12	0.56		9001.68	231	
232	2076509.593	412088.479	9017.42	0.80		9018.22	232	
233	2076513.539	410908.687	8978.27	0.47		8978.74	233	
234	2076517.462	411500.781	8987.18	0.31		8987.49	234	
235	2076520.030	412410.506	9036.08	0.66		9036.74	235	
236	2076529.695	412721.677	9047.09	-0.07		9047.02	236	
237	2076535.592	413306.264	9059.51	0.02		9059.53	237	
238	2076536.725	413611.807	9076.35	0.03		9076.38	238	
239	2076538.137	413015.348	9049.20	-0.39		9048.81	239	
240	2076542.870	414219.807	9135.10	0.58		9135.68	240	
241	2076544.257	413921.331	9102.83	0.43		9103.26	241	
242	2076545.436	414498.907	9146.24	0.93		9147.17	242	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
243	2076546.203	416316.603	9216.97	1.55	9218.52	243	
244	2076548.572	416010.171	9206.63	1.80	9208.43	244	
245	2076549.921	406994.200	8920.03	-0.10	8919.93	245	
246	2076551.183	416619.617	9225.04	0.05	9225.09	246	
247	2076552.515	416931.417	9233.35	1.59	9234.94	247	
248	2076558.852	415721.939	9193.91	1.64	9195.55	248	
249	2076561.909	414800.217	9155.53	1.09	9156.62	249	
250	2076562.963	415424.214	9173.74	1.18	9174.92	250	
251	2076565.805	417207.541	9243.21	1.39	9244.60	251	
252	2076566.314	418682.255	9244.23	3.19	9247.42	252	
253	2076573.688	417513.288	9251.73	2.28	9254.01	253	
254	2076573.869	417827.190	9247.35	2.08	9249.43	254	
255	2076576.768	415103.258	9158.39	0.89	9159.28	255	
256	2076593.689	418139.566	9249.32	1.97	9251.29	256	
257	2076765.871	412407.014	9064.49	0.55	9065.04	257	
258	2076771.863	410863.171	9012.95	1.19	9014.14	258	
259	2076773.378	407893.498	8998.55	0.01	8998.56	259	
260	2076775.162	407285.345	8974.76	-0.38	8974.38	260	
261	2076775.449	408179.572	8981.87	-0.01	8981.86	261	
262	2076776.200	407575.592	8994.39	-0.42	8993.97	262	
263	2076777.777	408473.482	8991.25	0.06	8991.31	263	
264	2076781.101	408777.571	8993.27	0.31	8993.58	264	
265	2076781.233	409079.505	8977.78	0.07	8977.85	265	
266	2076781.441	406992.169	8954.02	-0.89	8953.13	266	
267	2076785.696	409364.225	8964.58	0.31	8964.89	267	
268	2076791.695	409666.324	8974.39	0.22	8974.61	268	
269	2076792.809	412095.926	9055.21	1.31	9056.52	269	
270	2076795.633	409976.226	8990.23	-0.04	8990.19	270	
271	2076798.479	410273.776	9007.92	0.93	9008.85	271	
272	2076799.839	410577.745	9023.17	0.11	9023.28	272	
273	2076800.273	412651.421	9078.25	-0.42	9077.83	273	
274	2076803.418	411174.105	9012.77	0.09	9012.86	274	
275	2076806.850	411481.645	9013.33	-0.35	9012.98	275	
276	2076809.108	411774.505	9030.71	1.43	9032.14	276	
277	2076821.416	412967.083	9073.34	-0.09	9073.25	277	
278	2076834.173	413256.739	9086.53	0.13	9086.66	278	
279	2076837.820	414473.521	9179.70	0.21	9179.91	279	
280	2076839.313	413569.478	9104.29	0.11	9104.40	280	
281	2076840.829	414182.792	9149.19	0.21	9149.40	281	
282	2076841.418	413881.868	9121.93	0.44	9122.37	282	
283	2076842.537	414758.913	9186.79	-0.35	9186.44	283	
284	2076844.513	415085.053	9187.77	0.25	9188.02	284	
285	2076852.418	415394.268	9196.02	0.58	9196.60	285	
286	2076853.449	415679.774	9220.48	-0.07	9220.41	286	
287	2076854.166	416880.661	9267.52	1.08	9268.60	287	
288	2076854.226	417147.026	9278.04	1.37	9279.41	288	
289	2076858.943	416576.961	9267.05	1.12	9268.17	289	
290	2076864.493	418678.780	9282.57	2.57	9285.14	290	
291	2076865.160	418360.328	9279.62	2.30	9281.92	291	
292	2076865.909	416254.004	9261.98	2.35	9264.33	292	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
293	2076866.518	415980.209	9244.17	0.93	9245.10	293	
294	2076868.848	417769.759	9288.94	2.49	9291.43	294	
295	2076869.605	417463.849	9289.39	1.94	9291.33	295	
296	2076875.548	418066.460	9284.59	1.69	9286.28	296	
297	2077070.936	407582.190	9040.65	0.06	9040.71	297	
298	2077072.484	407898.206	9038.97	-0.66	9038.31	298	
299	2077075.424	408205.126	9027.73	-0.68	9027.05	299	
300	2077082.042	406998.004	9041.86	-0.31	9041.55	300	
301	2077082.369	408795.259	9038.69	-0.26	9038.43	301	
302	2077084.788	408502.932	9039.38	-0.37	9039.01	302	
303	2077086.185	409110.490	9015.50	0.26	9015.76	303	
304	2077087.389	407302.913	9039.28	-0.58	9038.70	304	
305	2077094.475	409697.869	9032.20	0.02	9032.22	305	
306	2077096.245	409395.856	9030.37	-0.27	9030.10	306	
307	2077099.747	410568.705	9082.28	0.46	9082.74	307	
308	2077103.405	409991.461	9043.88	-0.51	9043.37	308	
309	2077104.545	410893.804	9063.03	0.04	9063.07	309	
310	2077105.104	410296.037	9056.55	0.35	9056.90	310	
311	2077110.506	413616.441	9145.17	-0.44	9144.73	311	
312	2077111.236	411488.520	9057.26	0.76	9058.02	312	
313	2077111.711	411791.953	9071.42	0.25	9071.67	313	
314	2077112.676	412069.697	9097.31	0.58	9097.89	314	
315	2077113.972	411187.475	9067.23	0.08	9067.31	315	
316	2077115.636	412718.694	9115.11	-0.67	9114.44	316	
317	2077116.398	413312.806	9129.52	-0.56	9128.96	317	
318	2077118.535	412445.617	9124.29	0.77	9125.06	318	
319	2077125.387	413009.395	9112.01	-0.61	9111.40	319	
320	2077135.638	414778.248	9237.70	0.40	9238.10	320	
321	2077141.396	418675.217	9322.19	2.28	9324.47	321	
322	2077144.869	413921.949	9162.33	0.42	9162.75	322	
323	2077145.358	414490.603	9216.85	0.34	9217.19	323	
324	2077148.953	416050.491	9284.21	0.53	9284.74	324	
325	2077149.057	418104.603	9332.59	2.10	9334.69	325	
326	2077149.713	416310.230	9308.79	1.09	9309.88	326	
327	2077151.862	416617.820	9318.47	1.23	9319.70	327	
328	2077153.409	415115.610	9231.89	1.44	9233.33	328	
329	2077154.311	417495.828	9334.59	2.02	9336.61	329	
330	2077158.281	417851.766	9331.19	2.85	9334.04	330	
331	2077161.746	415737.397	9259.27	0.66	9259.93	331	
332	2077162.608	418398.411	9324.01	1.51	9325.52	332	
333	2077164.701	415408.855	9229.00	0.92	9229.92	333	
334	2077165.219	416914.972	9317.13	0.59	9317.72	334	
335	2077174.046	417227.008	9327.64	1.41	9329.05	335	
336	2077181.606	414208.077	9195.01	-0.05	9194.96	336	
337	2077327.144	408584.183	9103.77	-0.40	9103.37	337	
338	2077341.919	409427.893	9113.27	1.09	9114.36	338	
339	2077369.243	412440.405	9175.24	0.80	9176.04	339	
340	2077372.040	407304.093	9202.81	-0.03	9202.78	340	
341	2077375.260	408191.709	9220.95	0.42	9221.37	341	
342	2077377.800	407936.184	9194.09	-0.02	9194.07	342	

POINT	EASTING	NORTHING	1995	2001 STUDY ELEVATION	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION			BASE ELEVATION		
343	2077378.502	407034.029	9233.37	-0.01	9233.36	343		
344	2077380.015	413587.030	9211.01	0.14	9211.15	344		
345	2077394.763	409983.859	9128.89	0.55	9129.44	345		
346	2077395.978	412645.274	9167.72	-0.94	9166.78	346		
347	2077397.366	409679.669	9132.09	0.39	9132.48	347		
348	2077399.707	411496.044	9145.75	0.12	9145.87	348		
349	2077402.652	411205.346	9147.58	0.29	9147.87	349		
350	2077402.965	412950.462	9180.35	0.14	9180.49	350		
351	2077405.646	410882.927	9147.86	0.44	9148.30	351		
352	2077405.827	410221.835	9137.12	0.76	9137.88	352		
353	2077406.135	415651.618	9328.33	0.20	9328.53	353		
354	2077407.691	413278.777	9195.84	-0.48	9195.36	354		
355	2077409.167	407548.934	9182.48	-0.33	9182.15	355		
356	2077410.252	410542.455	9147.80	0.42	9148.22	356		
357	2077413.404	415030.801	9272.50	0.44	9272.94	357		
358	2077421.588	415362.935	9312.57	-0.02	9312.55	358		
359	2077424.785	414470.169	9253.52	0.03	9253.55	359		
360	2077426.097	416858.967	9365.78	0.59	9366.37	360		
361	2077426.868	414154.724	9242.50	-0.04	9242.46	361		
362	2077428.813	414723.692	9283.79	0.39	9284.18	362		
363	2077428.858	418082.652	9386.16	3.06	9389.22	363		
364	2077431.268	417772.752	9385.71	2.18	9387.89	364		
365	2077433.431	413924.580	9244.14	0.00	9244.14	365		
366	2077433.603	417178.339	9374.81	0.39	9375.20	366		
367	2077433.749	408830.537	9212.63	0.26	9212.89	367		
368	2077433.974	411773.423	9173.16	0.20	9173.36	368		
369	2077439.776	416550.490	9376.44	1.85	9378.29	369		
370	2077441.113	412095.887	9175.74	0.09	9175.83	370		
371	2077448.081	415970.215	9352.31	0.87	9353.18	371		
372	2077450.407	417472.218	9390.30	2.42	9392.72	372		
373	2077459.348	418342.719	9389.43	3.08	9392.51	373		
374	2077467.012	418649.456	9385.02	3.21	9388.23	374		
375	2077473.441	416249.283	9364.79	0.40	9365.19	375		
376	2077486.811	409078.793	9244.85	-0.80	9244.05	376		
377	2077617.220	416811.723	9418.69	-0.03	9418.66	377		
378	2077653.954	407389.895	9335.30	0.02	9335.32	378		
379	2077655.214	417753.204	9442.37	0.06	9442.43	379		
380	2077662.949	408527.324	9269.57	0.04	9269.61	380		
381	2077667.836	417044.337	9449.55	-0.23	9449.32	381		
382	2077677.808	412398.030	9243.95	0.03	9243.98	382		
384	2077705.279	409419.764	9343.74	0.07	9343.81	384		
385	2077706.029	408239.791	9378.46	-0.02	9378.44	385		
386	2077707.058	413860.681	9395.39	-0.06	9395.33	386		
387	2077713.671	417429.568	9466.77	0.06	9466.83	387		
388	2077714.351	409715.921	9334.18	0.22	9334.40	388		
389	2077722.152	410325.622	9353.00	-0.05	9352.95	389		
390	2077722.785	410015.663	9330.45	0.09	9330.54	390		
391	2077722.335	412131.521	9350.45	0.07	9350.52	391		
392	2077723.462	413633.072	9394.05	-0.02	9394.03	392		
393	2077723.663	407928.653	9307.54	-0.25	9307.29	393		

POINT	EASTING	NORTHING	1995	2001	2001	POINT	COMMENTS
			STUDY ELEVATION	2001 DIFFERENCE	BASE ELEVATION		
394	2077726.902	418152.914	9462.07	2.01	9464.08	394	
395	2077732.966	416598.184	9476.72	0.00	9476.72	395	
396	2077733.047	413372.927	9415.53	-0.01	9415.52	396	
397	2077736.450	412772.912	9390.06	-0.56	9389.50	397	
398	2077736.578	410900.265	9364.61	1.06	9365.67	398	
399	2077736.685	411737.335	9371.44	-0.95	9370.49	399	
400	2077746.821	413109.696	9405.91	0.01	9405.92	400	
401	2077751.745	415324.085	9534.40	-1.61	9532.79	401	
402	2077752.566	415932.907	9537.95	-1.81	9536.14	402	
403	2077752.693	415632.986	9530.80	-1.14	9529.66	403	
404	2077755.497	409050.595	9381.72	-0.08	9381.64	404	
405	2077758.768	408804.221	9278.17	0.97	9279.14	405	
406	2077758.773	416238.547	9548.70	-1.09	9547.61	406	
407	2077761.250	411521.427	9384.48	1.82	9386.30	407	
408	2077762.691	418677.222	9467.16	1.13	9468.29	408	
409	2077763.913	418088.944	9475.38	0.00	9475.38	409	
410	2077766.600	418385.690	9473.30	0.41	9473.71	410	
411	2077767.387	411199.842	9384.91	-0.23	9384.68	411	
412	2077769.532	410619.303	9280.37	0.08	9280.45	412	
413	2077774.996	407709.917	9198.96	-0.42	9198.54	413	
414	2077784.328	414966.591	9434.96	-0.24	9434.72	414	
416	2077977.570	417956.009	9554.93	-0.76	9554.17	416	
417	2077991.702	415647.014	9652.08	-3.17	9648.91	417	
418	2077993.098	415373.835	9651.37	-2.24	9649.13	418	
419	2078009.322	416581.861	9558.92	-1.54	9557.38	419	
420	2078009.957	411739.624	9523.39	1.89	9525.28	420	
421	2078014.165	412604.064	9410.00	0.95	9410.95	421	
422	2078015.585	410894.682	9495.94	-0.23	9495.71	422	
423	2078021.702	411169.941	9518.79	-0.14	9518.65	423	
424	2078022.117	411423.848	9484.11	0.26	9484.37	424	
425	2078027.614	415977.361	9676.63	-2.47	9674.16	425	
426	2078030.955	407686.494	9245.08	-0.11	9244.97	426	
427	2078032.505	410611.536	9385.63	-0.60	9385.03	427	
428	2078034.658	408649.050	9300.77	-0.07	9300.70	428	
429	2078038.452	409739.749	9477.59	-0.05	9477.54	429	
430	2078042.377	410247.077	9492.56	-0.48	9492.08	430	
431	2078043.741	410015.211	9489.36	0.06	9489.42	431	
432	2078045.520	408922.564	9404.20	-1.12	9403.08	432	
433	2078054.818	413840.001	9602.54	-2.10	9600.44	433	
434	2078055.142	414117.045	9619.76	-0.72	9619.04	434	
435	2078057.519	408181.298	9496.34	-0.86	9495.48	435	
436	2078059.763	409456.376	9544.37	-0.34	9544.03	436	
437	2078063.062	413527.239	9562.71	-0.40	9562.31	437	
438	2078065.623	413261.367	9589.85	-1.59	9588.26	438	
439	2078083.292	412039.022	9553.10	0.72	9553.82	439	
440	2078093.765	409201.227	9560.60	0.08	9560.68	440	
441	2078110.326	417007.273	9696.68	-1.01	9695.67	441	
442	2078111.788	415056.226	9509.32	-2.81	9506.51	442	
443	2078121.857	412942.249	9591.23	0.00	9591.23	443	
444	2078133.011	414433.546	9626.76	-0.23	9626.53	444	

POINT	EASTING	NORTHING	1995 STUDY ELEVATION	2001 DIFFERENCE	2001 BASE ELEVATION	POINT	COMMENTS
445	2078247.352	417736.019	9672.86	-1.51	9671.35	445	
447	2078257.796	413864.903	9697.16	0.04	9697.20	447	
448	2078267.822	414937.082	9462.91	-1.72	9461.19	448	
449	2078292.610	408799.342	9418.64	-0.38	9418.26	449	
450	2078301.331	416532.685	9616.62	-2.18	9614.44	450	
451	2078311.547	409059.426	9553.52	-0.45	9553.07	451	
452	2078353.533	410857.308	9607.33	-3.77	9603.56	452	
453	2078354.224	411137.838	9694.88	-2.15	9692.73	453	
454	2078364.331	413654.280	9724.49	-0.66	9723.83	454	
455	2078366.027	410275.851	9577.78	0.03	9577.81	455	
456	2078375.574	409395.539	9663.26	0.44	9663.70	456	
457	2078383.019	410621.898	9496.45	-1.81	9494.64	457	
458	2078394.824	417907.170	9773.40	0.00	9773.40	458	
459	2078404.264	415701.062	9852.85	0.04	9852.89	459	
460	2078413.346	412631.116	9543.68	-0.30	9543.38	460	
461	2078423.908	408199.568	9574.99	0.07	9575.06	461	
462	2078424.906	414154.702	9813.25	0.07	9813.32	462	
463	2078426.111	415432.012	9745.96	-4.48	9741.48	463	
464	2078441.123	409650.144	9661.74	-0.54	9661.20	464	
465	2078443.435	411709.163	9740.91	-0.37	9740.54	465	
466	2078456.871	417037.658	9880.88	-1.08	9879.80	466	
467	2078456.885	407653.147	9373.58	0.13	9373.71	467	
468	2078457.420	413347.459	9764.94	-0.34	9764.60	468	
469	2078466.935	411362.218	9705.03	-2.46	9702.57	469	
470	2078468.237	413127.991	9769.74	-0.05	9769.69	470	
471	2078470.900	410029.721	9674.02	-1.99	9672.03	471	
472	2078473.904	416770.068	9771.95	-3.46	9768.49	472	
473	2078474.252	416091.219	9804.14	-4.87	9799.27	473	
474	2078520.643	417321.463	9890.23	-0.38	9889.85	474	
476	2078574.858	411906.212	9754.11	-2.38	9751.73	476	
477	2078583.147	412356.375	9572.50	-0.41	9572.09	477	
478	2078599.885	413888.700	9848.80	-0.02	9848.78	478	
479	2078617.669	415075.189	9606.40	-3.29	9603.11	479	
480	2078624.884	410291.579	9667.91	-1.17	9666.74	480	
481	2078632.011	417777.743	9839.55	-0.66	9838.89	481	
482	2078654.261	408803.055	9569.01	-0.71	9568.30	482	
483	2078662.668	412976.862	9756.09	-0.10	9755.99	483	
484	2078669.874	407939.206	9569.87	0.04	9569.91	484	
485	2078670.293	409073.205	9648.38	0.27	9648.65	485	
486	2078672.957	410885.248	9710.43	-3.75	9706.68	486	
487	2078679.036	413604.746	9842.15	-0.29	9841.86	487	
488	2078683.998	410559.020	9629.43	-2.56	9626.87	488	
489	2078685.652	416548.919	9751.70	-3.06	9748.64	489	
490	2078686.464	416183.369	9824.70	-0.13	9824.57	490	
491	2078693.533	415733.365	9949.65	-5.86	9943.79	491	
492	2078702.149	413353.352	9843.78	0.07	9843.85	492	
493	2078703.928	411118.440	9813.39	-2.12	9811.27	493	
494	2078718.302	416863.261	9875.35	-2.50	9872.85	494	
495	2078738.455	409903.137	9802.65	-2.29	9800.36	495	
496	2078791.597	417158.140	10044.31	-0.92	10043.39	496	

POINT	EASTING	NORTHING	1995	2001 STUDY ELEVATION	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION			BASE ELEVATION		
497	2078796.984	409506.035	9868.91	0.28		9869.19	497	
498	2078808.760	408483.181	9634.49	-0.40		9634.09	498	
499	2078809.579	408214.750	9719.11	0.16		9719.27	499	
500	2078860.561	411458.313	9910.29	-3.41		9906.88	500	
501	2078862.614	412389.103	9653.14	-0.10		9653.04	501	
502	2078864.060	414684.834	9680.02	-0.06		9679.96	502	
503	2078875.866	410193.285	9803.87	-0.29		9803.58	503	
504	2078876.903	407628.913	9562.98	-0.40		9562.58	504	
505	2078894.259	412729.500	9714.69	0.14		9714.83	505	
506	2078901.193	413948.220	10032.91	-0.20		10032.71	506	
507	2078902.630	410875.949	9783.04	-2.56		9780.48	507	
508	2078905.403	413666.146	9981.07	0.03		9981.10	508	
509	2078906.840	411721.610	9966.50	-1.62		9964.88	509	
510	2078908.558	416612.253	9865.02	-2.19		9862.83	510	
511	2078912.617	413087.455	9830.91	0.03		9830.94	511	
512	2078928.744	417892.060	10016.58	-0.02		10016.56	512	
513	2078943.842	415858.289	10067.93	-5.18		10062.75	513	
515	2078960.541	407880.213	9660.30	-0.03		9660.27	515	
516	2078962.331	415478.680	9860.66	-4.88		9855.78	516	
517	2078999.972	410571.191	9783.04	-1.16		9781.88	517	
518	2079007.439	416828.813	9968.74	-1.99		9966.75	518	
519	2079007.633	417212.526	10138.06	-0.72		10137.34	519	
520	2079008.594	409085.598	9771.23	0.31		9771.54	520	
521	2079019.184	415010.411	9682.41	-2.72		9679.69	521	
522	2079024.978	408739.251	9707.99	-0.24		9707.75	522	
523	2079036.729	417604.373	10022.58	-1.14		10021.44	523	
524	2079047.226	408204.857	9828.10	0.33		9828.43	524	
525	2079050.768	413383.901	10034.91	0.03		10034.94	525	
526	2079165.119	411683.115	10087.69	-3.45		10084.24	526	
527	2079170.521	407570.344	9674.41	-0.48		9673.93	527	
528	2079183.351	412745.496	9805.03	-0.13		9804.90	528	
529	2079197.243	410291.942	9949.99	-1.77		9948.22	529	
530	2079203.057	410910.553	9972.37	-3.06		9969.31	530	
532	2079211.499	415388.869	9884.96	-3.07		9881.89	532	
533	2079214.744	409641.740	10034.50	0.03		10034.53	533	
534	2079230.262	415688.640	10027.25	-3.33		10023.92	534	
535	2079231.145	416895.453	10087.25	-2.50		10084.75	535	
536	2079231.992	411202.534	10098.43	-3.83		10094.60	536	
537	2079233.930	410018.925	10036.27	-1.92		10034.35	537	
538	2079235.425	415115.330	9778.33	-1.77		9776.56	538	
539	2079237.432	413635.948	10139.25	-0.03		10139.22	539	
540	2079242.727	417757.912	10163.16	-1.34		10161.82	540	
541	2079243.157	415903.618	10132.58	-4.74		10127.84	541	
542	2079245.082	413832.474	10171.13	0.01		10171.14	542	
543	2079247.960	412359.203	9867.75	-2.28		9865.47	543	
544	2079249.441	414266.125	9972.340					obscure
545	2079258.108	417275.659	10264.90	-2.72		10262.18	545	
546	2079264.704	413083.054	9990.39	0.00		9990.39	546	
547	2079286.252	407859.478	9783.65	-0.06		9783.59	547	
549	2079296.109	410572.769	9963.27	0.04		9963.31	549	

POINT	EASTING	NORTHING	1995	2001 STUDY ELEVATION	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION			BASE ELEVATION		
550	2079305.439	412087.051	9941.61	-2.19	9939.42	550		
551	2079309.524	413404.059	10155.22	-0.04	10155.18	551		
552	2079315.179	417516.922	10215.37	-2.21	10213.16	552		
553	2079319.514	408782.708	9873.67	-3.37	9870.30	553		
554	2079327.312	414853.045	9734.28	-0.83	9733.45	544		
555	2079328.045	408262.240	9933.17	-0.22	9932.95	555		
556	2079328.690	416588.351	10031.67	-2.99	10028.68	556		
557	2079348.162	409093.074	9916.40	0.46	9916.86	557		
558	2079353.155	416285.939	10052.15	-4.65	10047.50	558		
559	2079417.198	408517.305	9928.00	-0.02	9927.98	559		
561	2079513.802	415354.372	9975.58	-2.56	9973.02	561		
562	2079514.358	415671.206	10136.68	-4.65	10132.03	562		
563	2079515.313	415000.281	9882.930					obscure
564	2079538.427	414604.856	9894.990					obscure
565	2079544.886	413267.894	10174.58	0.02	10174.60	565		
566	2079547.534	416894.454	10233.07	-4.47	10228.60	566		
567	2079552.675	417277.174	10366.10	-4.38	10361.72	567		
568	2079555.568	413537.332	10275.39	0.11	10275.50	568		
569	2079559.334	413812.992	10255.290					obscure
570	2079565.599	415950.746	10261.66	-4.46	10257.20	570		
571	2079574.596	407854.713	9934.44	0.05	9934.49	571		
573	2079593.755	417669.223	10331.99	-3.63	10328.36	573		
574	2079617.468	412775.821	10070.90	1.44	10072.34	574		
575	2079627.019	409536.688	10139.70	0.12	10139.82	575		
576	2079627.728	410672.430	10149.52	-1.43	10148.09	576		
577	2079635.053	416232.892	10215.10	-4.75	10210.35	577		
578	2079637.739	410090.080	10192.12	-1.60	10190.52	578		
579	2079640.580	411663.374	10202.88	-3.46	10199.42	579		
580	2079641.980	412229.726	10099.67	-2.28	10097.39	580		
581	2079646.996	411333.375	10261.42	-1.15	10260.27	581		
582	2079648.732	408911.030	10030.35	0.65	10031.00	582		
583	2079655.237	409261.767	10081.41	1.02	10082.43	583		
584	2079655.497	416601.362	10201.49	-4.81	10196.68	584		
585	2079665.946	409842.086	10220.34	-1.51	10218.83	585		
586	2079669.657	408622.731	10040.08	0.65	10040.73	586		
587	2079689.014	411996.840	10154.28	-1.77	10152.51	587		
588	2079692.386	408028.867	10003.68	0.66	10004.34	588		
589	2079695.443	411068.280	10226.45	-1.32	10225.13	589		
590	2079695.531	412473.143	10092.20	0.05	10092.25	590		
591	2079706.441	410446.607	10165.73	-0.83	10164.90	591		
592	2079754.447	408298.391	10100.72	0.40	10101.12	592		
595	2079835.076	414339.802	10134.66	0.04	10134.70	595		
596	2079838.583	417448.923	10444.78	-5.97	10438.81	596		
597	2079839.206	415984.906	10344.26	-4.47	10339.79	597		
598	2079843.279	413273.770	10286.03	0.02	10286.05	598		
599	2079845.115	417136.729	10431.93	-4.91	10427.02	599		
600	2079850.556	415628.098	10204.96	-4.65	10200.31	600		
601	2079851.817	416833.319	10349.35	-5.31	10344.04	601		
602	2079852.530	413534.749	10381.06	0.29	10381.35	602		
603	2079854.253	415374.458	10133.52	-3.97	10129.55	603		

POINT	EASTING	NORTHING	1995	2001	2001	POINT	COMMENTS
			STUDY ELEVATION	2001 DIFFERENCE	BASE ELEVATION		
604	2079855.925	417727.546	10434.23	-4.81	10429.42	604	
605	2079865.446	414735.680	10000.88	0.02	10000.90	605	
606	2079865.599	411663.608	10272.54	-2.51	10270.03	606	
607	2079870.858	416264.634	10318.11	-4.05	10314.06	607	
608	2079875.569	415049.469	10104.08	-0.04	10104.04	608	
609	2079904.932	413883.252	10330.100				obscure
610	2079921.059	408638.789	10136.74	1.23	10137.97	610	
611	2079934.149	416600.727	10334.14	-4.78	10329.36	611	
612	2079939.244	409220.153	10180.14	1.28	10181.42	612	
614	2079953.127	410434.492	10286.59	-1.96	10284.63	614	
615	2079963.134	408938.296	10152.01	0.27	10152.28	615	
616	2079963.254	410132.981	10313.73	0.21	10313.94	616	
617	2079963.619	410725.586	10318.57	-2.46	10316.11	617	
618	2079966.973	409534.925	10241.44	0.47	10241.91	618	
620	2079967.209	408064.802	10124.68	0.80	10125.48	620	
623	2079975.682	412788.577	10233.34	0.39	10233.73	623	
624	2079978.879	414160.443	10252.85	0.64	10253.49	624	
625	2079979.879	412165.562	10237.54	-0.38	10237.16	625	
626	2079980.933	411305.126	10376.22	-3.41	10372.81	626	
627	2079982.695	411956.538	10267.17	-1.96	10265.21	627	
628	2079985.960	412537.992	10236.21	0.16	10236.37	628	
629	2079986.217	411030.844	10343.27	-2.30	10340.97	629	
630	2080015.532	409863.611	10355.77	-2.11	10353.66	630	
631	2080019.402	417136.529	10509.09	-5.76	10503.33	631	
632	2080019.441	413112.649	10302.47	-0.30	10302.17	632	
633	2080039.931	417499.171	10508.40	-6.51	10501.89	633	
634	2080092.467	415364.712	10242.66	-2.76	10239.90	634	
635	2080104.500	416032.369	10436.82	-5.50	10431.32	635	
636	2080124.478	416853.177	10468.13	-5.79	10462.34	636	
637	2080136.305	415707.277	10339.99	-4.39	10335.60	637	
638	2080141.550	416562.245	10436.99	-6.40	10430.59	638	
639	2080146.772	416256.511	10440.05	-5.62	10434.43	639	
640	2080161.223	415051.851	10226.17	-3.48	10222.69	640	
641	2080173.603	414738.443	10187.57	-2.52	10185.05	641	
642	2080200.853	411028.016	10395.83	-3.64	10392.19	642	
643	2080210.609	411334.784	10367.61	-3.54	10364.07	643	
644	2080213.252	414272.881	10313.31	0.07	10313.38	644	
645	2080215.586	410462.454	10409.05	-1.69	10407.36	645	
646	2080219.509	408606.565	10254.94	0.32	10255.26	646	
647	2080224.983	408261.473	10291.68	0.04	10291.72	647	
648	2080225.739	409220.467	10257.44	0.03	10257.47	648	
649	2080235.795	414514.522	10236.91	0.73	10237.64	649	
651	2080254.400	408917.813	10236.84	-0.21	10236.63	651	
653	2080255.204	411634.738	10345.15	-3.82	10341.33	653	
654	2080259.962	410723.491	10439.11	-2.91	10436.20	654	
656	2080265.171	411936.302	10336.27	-3.18	10333.09	656	
657	2080265.352	410143.268	10392.08	-3.28	10388.80	657	
658	2080266.221	409837.923	10298.53	-1.27	10297.26	658	
659	2080271.569	409534.868	10275.78	-1.20	10274.58	659	
660	2080281.706	414057.157	10383.04	0.05	10383.09	660	

POINT	EASTING	NORTHING	1995	2001 BASE ELEVATION	POINT	COMMENTS
			STUDY ELEVATION			
1064	2083528.852	409270.939	9265.48	-0.10	9265.38	1064
1065	2083529.130	412627.586	9529.02	0.04	9529.06	1065
1066	2083531.981	414551.463	10113.21	0.10	10113.31	1066
1069	2083551.830	413917.513	10039.21	-0.68	10038.53	1069
1070	2083555.674	414386.353	10072.52	-0.36	10072.16	1070
1071	2083558.214	407710.410	9659.48	-0.01	9659.47	1071
1072	2083573.955	410140.768	9603.65	0.01	9603.66	1072
1075	2083630.115	418459.299	10019.18	0.61	10019.79	1075
1076	2083633.692	418187.191	9990.62	0.52	9991.14	1076
1077	2083643.536	415429.420	10098.34	-1.90	10096.44	1077
1078	2083699.046	417138.428	10258.36	-0.26	10258.10	1078
1079	2083700.683	415139.157	10160.80	0.10	10160.90	1079
1080	2083708.936	416844.277	10105.43	-0.10	10105.33	1080
1081	2083717.821	416277.534	9874.85	-0.36	9874.49	1081
1082	2083745.390	411576.379	9438.28	-1.26	9437.02	1082
1083	2083751.124	417844.029	10024.12	0.08	10024.20	1083
1084	2083754.764	415971.286	9858.52	0.21	9858.73	1084
1085	2083785.542	410142.417	9553.38	-0.09	9553.29	1085
1086	2083787.537	418111.713	9956.11	0.34	9956.45	1086
1087	2083788.186	415751.726	9900.25	0.86	9901.11	1087
1088	2083789.657	412164.511	9151.51	-0.28	9151.23	1088
1089	2083792.086	413902.088	9911.38	-0.03	9911.35	1089
1090	2083796.592	409783.991	9449.01	0.08	9449.09	1090
1091	2083799.915	413494.538	9880.17	-0.31	9879.86	1091
1092	2083807.478	417501.199	10138.05	0.05	10138.10	1092
1093	2083831.829	409491.678	9289.45	1.58	9291.03	1093
1094	2083835.456	414167.622	9928.71	-1.03	9927.68	1094
1097	2083848.864	414811.330	10088.82	-0.79	10088.03	1097
1099	2083861.769	408381.432	9324.53	0.02	9324.55	1099
1100	2083870.199	414505.957	9980.67	-0.80	9979.87	1100
1101	2083879.997	408975.239	9080.89	-0.64	9080.25	1101
1102	2083886.992	408070.466	9510.06	-0.05	9510.01	1102
1103	2083891.549	407767.406	9662.04	-0.13	9661.91	1103
1105	2083900.711	416481.667	9918.75	0.01	9918.76	1105
1106	2083911.176	408654.091	9210.63	0.20	9210.83	1106
1107	2083912.602	410708.307	9648.92	-0.32	9648.60	1107
1108	2083925.493	409250.353	9165.64	2.46	9168.10	1108
1109	2083929.727	417153.032	10231.67	0.15	10231.82	1109
1110	2083937.026	412588.622	9416.27	-0.49	9415.78	1110
1113	2083967.806	418458.663	9953.86	-0.27	9953.59	1113
1114	2083996.763	413243.400	9744.66	-0.15	9744.51	1114
1115	2084009.237	413624.356	9776.08	-0.48	9775.60	1115
1116	2084012.198	415062.472	10119.07	-0.47	10118.60	1116
1117	2084019.824	410968.131	9541.42	-0.02	9541.40	1117
1118	2084020.067	415433.249	9953.47	-1.22	9952.25	1118
1119	2084029.412	413004.470	9644.13	-0.19	9643.94	1119
1120	2084030.209	418057.638	9854.20	0.58	9854.78	1120
1121	2084055.731	411691.288	9203.49	-0.37	9203.12	1121
1122	2084061.140	417617.853	10039.13	-0.29	10038.84	1122
1123	2084106.922	416894.324	10108.52	-0.16	10108.36	1123

POINT	EASTING	NORTHING	1995 STUDY ELEVATION	1995	2001 BASE ELEVATION	2001 BASE ELEVATION	POINT	COMMENTS
				STUDY ELEVATION				
1124	2084107.025	415797.893	9761.45	-0.07	9761.38	1124		
1125	2084129.660	416102.377	9730.18	-0.51	9729.67	1125		
1126	2084137.169	412236.299	9238.47	0.42	9238.89	1126		
1127	2084146.966	414061.314	9765.72	-0.05	9765.67	1127		
1128	2084150.490	410345.623	9547.06	0.43	9547.49	1128		
1129	2084153.409	411995.563	9001.42	-0.98	9000.44	1129		
1130	2084155.858	410097.338	9420.67	0.03	9420.70	1130		
1131	2084161.262	414307.508	9816.71	-0.65	9816.06	1131		
1132	2084168.097	414720.708	9989.04	-0.59	9988.45	1132		
1133	2084174.150	409726.709	9219.90	-0.17	9219.73	1133		
1134	2084179.366	411342.879	9367.77	-0.90	9366.87	1134		
1135	2084189.389	417193.250	10198.92	0.30	10199.22	1135		
1136	2084207.279	416588.720	9928.27	0.07	9928.34	1136		
1140	2084267.899	413329.465	9654.45	-0.20	9654.25	1140		
1141	2084277.031	410564.348	9584.89	1.90	9586.79	1141		
1143	2084290.575	408538.022	9310.13	0.23	9310.36	1143		
1144	2084291.986	408230.380	9495.40	0.11	9495.51	1144		
1145	2084295.297	412632.842	9461.22	-0.19	9461.03	1145		
1146	2084301.586	409479.567	9156.60	-0.40	9156.20	1146		
1147	2084305.008	407783.205	9719.77	-0.23	9719.54	1147		
1148	2084307.367	408833.854	9128.11	0.20	9128.31	1148		
1149	2084310.672	415131.070	10016.57	-0.61	10015.96	1149		
1150	2084326.167	411140.238	9320.82	-0.80	9320.02	1150		
1151	2084343.662	417888.585	9866.81	-0.04	9866.77	1151		
1152	2084359.420	415443.433	9836.19	-0.11	9836.08	1152		
1153	2084360.343	413899.500	9667.34	-0.36	9666.98	1153		
1154	2084370.300	414262.633	9792.28	-0.50	9791.78	1154		
1157	2084385.272	418084.074	9776.80	0.17	9776.97	1157		
1158	2084387.420	418463.144	9823.80	3.27	9827.07	1158		
1159	2084390.968	417267.173	10146.75	0.33	10147.08	1159		
1160	2084393.708	409214.066	8978.76	0.20	8978.96	1160		
1161	2084396.693	408042.007	9558.55	-0.26	9558.29	1161		
1162	2084408.087	417656.246	9949.56	0.20	9949.76	1162		
1163	2084409.220	414528.611	9892.40	0.08	9892.48	1163		
1164	2084409.338	416002.247	9665.91	0.07	9665.98	1164		
1165	2084421.149	413063.412	9585.34	-0.38	9584.96	1165		
1166	2084425.543	414947.276	10051.19	-0.51	10050.68	1166		
1167	2084425.716	413615.470	9582.78	-0.76	9582.02	1167		
1169	2084474.189	415665.096	9723.22	0.36	9723.58	1169		
1170	2084480.327	416685.710	9886.90	0.37	9887.27	1170		
1171	2084481.361	416245.738	9710.76	-0.14	9710.62	1171		
1172	2084566.412	416859.644	9925.81	0.04	9925.85	1172		
1173	2084575.995	411895.477	8897.75	3.29	8901.04	1173		
1174	2084583.568	411473.208	9093.57	1.11	9094.68	1174		
1175	2084589.584	412293.019	9196.35	0.90	9197.25	1175		
1176	2084600.723	415340.678	9812.62	-0.05	9812.57	1176		
1177	2084610.238	410134.772	9408.14	0.34	9408.48	1177		
1178	2084611.929	414785.520	10018.38	-2.19	10016.19	1178		
1179	2084621.454	412617.179	9396.08	-0.43	9395.65	1179		
1180	2084630.831	414189.755	9754.67	-0.72	9753.95	1180		

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1237	2085054.918	407769.943	9312.17	0.08	9312.25	1237	
1238	2085067.242	411512.583	8936.43	0.20	8936.63	1238	
1239	2085068.048	410136.312	9333.47	0.44	9333.91	1239	
1241	2085081.727	408142.841	9386.10	-0.28	9385.82	1241	
1242	2085116.823	413580.896	9464.91	-1.49	9463.42	1242	
1243	2085118.866	409570.418	8982.55	0.08	8982.63	1243	
1244	2085146.835	416279.746	9569.19	-0.36	9568.83	1244	
1245	2085149.131	417389.805	9900.40	0.05	9900.45	1245	
1246	2085150.899	408505.282	9204.74	-0.33	9204.41	1246	
1247	2085159.278	409802.120	9161.28	1.66	9162.94	1247	
1248	2085165.741	418490.949	9699.46	-0.08	9699.38	1248	
1249	2085167.926	415869.312	9576.13	-0.55	9575.58	1249	
1250	2085196.658	414178.183	9742.08	-0.69	9741.39	1250	
1251	2085215.401	414764.044	9942.75	0.75	9943.50	1251	
1252	2085219.122	414487.673	9893.61	-0.53	9893.08	1252	
1253	2085222.594	409157.379	8853.55	-0.21	8853.34	1253	
1254	2085243.970	415105.963	9779.01	-0.04	9778.97	1254	
1255	2085245.575	413316.491	9326.89	-1.06	9325.83	1255	
1256	2085245.783	417107.040	9784.48	0.18	9784.66	1256	
1257	2085247.679	413898.190	9651.34	-0.49	9650.85	1257	
1258	2085247.798	416693.982	9656.85	-0.08	9656.77	1258	
1259	2085252.668	415388.477	9660.49	-0.57	9659.92	1259	
1260	2085255.229	412989.660	9120.98	-0.42	9120.56	1260	
1261	2085285.425	418069.694	9638.84	-0.29	9638.55	1261	
1262	2085288.420	412448.527	8994.19	-0.98	8993.21	1262	
1263	2085337.511	415655.462	9521.06	-1.02	9520.04	1263	
1264	2085356.409	413571.013	9483.46	0.18	9483.64	1264	
1265	2085361.361	417746.588	9746.10	-0.02	9746.08	1265	
1266	2085362.422	412684.307	8948.40	-0.69	8947.71	1266	
1267	2085401.500	412179.691	8891.56	0.01	8891.57	1267	
1268	2085421.119	409806.459	9166.49	1.72	9168.21	1268	
1269	2085427.683	408906.306	8918.72	0.03	8918.75	1269	
1270	2085432.155	417409.335	9876.21	0.37	9876.58	1270	
1271	2085451.462	408329.003	9230.19	-0.06	9230.13	1271	
1272	2085452.450	418484.828	9654.83	0.14	9654.97	1272	
1273	2085461.917	413829.670	9635.83	-0.51	9635.32	1273	
1274	2085477.156	409552.917	8940.40	0.12	8940.52	1274	
1275	2085486.195	410478.830	9514.30	0.02	9514.32	1275	
1276	2085486.682	416216.955	9451.27	-0.72	9450.55	1276	
1277	2085489.699	411844.079	8742.62	-0.29	8742.33	1277	
1278	2085501.529	407888.781	9167.86	0.10	9167.96	1278	
1279	2085503.212	410185.261	9369.51	0.28	9369.79	1279	
1280	2085509.395	415872.627	9498.37	-0.15	9498.22	1280	
1282	2085517.245	407498.433	8998.58	-0.17	8998.41	1282	
1283	2085523.931	414772.996	9809.10	-0.07	9809.03	1283	
1284	2085530.083	415084.342	9661.02	-0.02	9661.00	1284	
1285	2085532.225	418699.932	9733.75	0.00	9733.75	1285	
1286	2085532.443	416938.862	9660.87	0.13	9661.00	1286	
1287	2085534.566	408126.472	9144.56	0.31	9144.87	1287	
1288	2085550.704	415384.289	9547.50	-0.35	9547.15	1288	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1289	2085551.293	416634.136	9539.78	-0.23	9539.55	1289	
1290	2085552.646	414210.309	9754.31	-1.34	9752.97	1290	
1291	2085554.432	413294.841	9402.43	-0.21	9402.22	1291	
1292	2085558.085	414565.563	9911.13	-0.64	9910.49	1292	
1293	2085567.491	418077.424	9573.26	0.00	9573.26	1293	
1294	2085576.378	411100.734	9223.84	-0.20	9223.64	1294	
1295	2085599.529	409279.139	8800.89	-0.03	8800.86	1295	
1296	2085610.734	417175.191	9756.17	0.12	9756.29	1296	
1297	2085629.519	417740.436	9715.45	0.12	9715.57	1297	
1298	2085674.724	412920.547	9210.60	-0.13	9210.47	1298	
1299	2085680.295	413590.972	9567.34	0.00	9567.34	1299	
1300	2085680.723	417447.179	9843.42	0.21	9843.63	1300	
1301	2085691.777	412632.076	8984.71	-0.37	8984.34	1301	
1302	2085746.748	418442.036	9582.28	0.00	9582.28	1302	
1303	2085775.259	416409.361	9344.25	-0.08	9344.17	1303	
1304	2085778.168	410053.619	9244.25	-0.65	9243.60	1304	
1305	2085779.904	416036.905	9408.59	-0.36	9408.23	1305	
1307	2085789.289	415666.264	9322.82	0.10	9322.92	1307	
1308	2085816.041	408347.421	9034.27	-0.02	9034.25	1308	
1309	2085818.378	413893.604	9695.04	0.00	9695.04	1309	
1310	2085820.483	418062.112	9544.56	0.00	9544.56	1310	
1311	2085824.871	410521.382	9452.07	0.12	9452.19	1311	
1312	2085829.305	414307.711	9768.82	0.17	9768.99	1312	
1313	2085840.888	413295.211	9445.23	-0.57	9444.66	1313	
1314	2085843.788	409708.918	9012.11	5.58	9017.69	1314	
1315	2085847.377	411236.002	9075.14	0.51	9075.65	1315	
1316	2085852.218	415087.739	9633.40	-0.54	9632.86	1316	
1317	2085852.818	416633.935	9446.31	-0.36	9445.95	1317	
1318	2085861.238	409093.047	8765.22	-0.02	8765.20	1318	
1319	2085872.908	416969.173	9597.24	-0.01	9597.23	1319	
1320	2085877.074	407675.693	8900.13	0.02	8900.15	1320	
1321	2085884.224	410839.724	9326.18	0.32	9326.50	1321	
1322	2085893.117	415383.401	9522.86	-0.59	9522.27	1322	
1323	2085897.078	408024.533	8899.38	0.06	8899.44	1323	
1324	2085898.364	411967.723	8665.64	-0.23	8665.41	1324	
1325	2085915.538	412306.330	8810.97	-0.42	8810.55	1325	
1326	2085918.211	414762.976	9814.96	-1.73	9813.23	1326	
1327	2085923.328	409408.426	8819.49	-0.10	8819.39	1327	
1328	2085940.494	408713.549	8904.93	0.25	8905.18	1328	
1329	2085966.660	418324.805	9403.09	-0.17	9402.92	1329	
1330	2085975.628	418624.577	9564.03	0.04	9564.07	1330	
1332	2086002.143	409878.211	9164.69	2.13	9166.82	1332	
1333	2086027.832	417747.924	9675.75	0.00	9675.75	1333	
1334	2086032.733	407444.845	8934.41	0.09	8934.50	1334	
1335	2086041.053	414869.475	9750.88	0.00	9750.88	1335	
1336	2086046.761	412803.570	9091.04	-0.07	9090.97	1336	
1337	2086052.894	416184.018	9286.39	0.29	9286.68	1337	
1338	2086085.837	410241.843	9333.23	-2.63	9330.60	1338	
1339	2086088.885	415843.918	9210.03	-0.02	9210.01	1339	
1340	2086095.593	413498.497	9492.36	0.00	9492.36	1340	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1341	2086098.857	414208.380	9703.07	0.00	9703.07	1341	
1342	2086099.018	417220.033	9688.82	0.00	9688.82	1342	
1343	2086105.800	413676.079	9576.15	0.00	9576.15	1343	
1344	2086128.610	411164.224	9196.77	0.05	9196.82	1344	
1345	2086136.141	410551.745	9499.37	-0.15	9499.22	1345	
1346	2086156.398	415309.722	9513.81	0.00	9513.81	1346	
1347	2086160.907	414443.218	9749.47	0.00	9749.47	1347	
1348	2086161.289	418046.164	9514.75	0.15	9514.90	1348	
1349	2086163.233	414648.656	9751.42	0.00	9751.42	1349	
1350	2086188.262	413295.760	9387.53	0.00	9387.53	1350	
1351	2086196.405	408280.713	8787.33	0.17	8787.50	1351	
1352	2086225.618	418398.784	9345.84	-0.29	9345.55	1352	
1353	2086239.631	413030.627	9261.27	0.00	9261.27	1353	
1354	2086241.186	416955.572	9568.63	0.00	9568.63	1354	
1355	2086250.074	409441.022	8842.52	-0.44	8842.08	1355	
1356	2086252.761	408019.583	8805.23	0.12	8805.35	1356	
1357	2086269.848	414999.756	9622.58	0.00	9622.58	1357	
1358	2086271.777	408540.610	8756.69	-0.01	8756.68	1358	
1359	2086291.801	416653.226	9355.91	0.00	9355.91	1359	
1360	2086299.375	418727.723	9452.83	-0.29	9452.54	1360	
1361	2086317.581	417738.590	9659.88	-0.53	9659.35	1361	
1362	2086328.030	417044.618	9603.20	-0.96	9602.24	1362	
1363	2086328.325	409143.252	8710.47	0.04	8710.51	1363	
1364	2086335.333	410595.985	9419.48	0.18	9419.66	1364	
1365	2086343.236	412589.959	8893.28	-0.32	8892.96	1365	
1366	2086348.562	411771.337	8730.24	-0.92	8729.32	1366	
1367	2086349.628	414496.877	9716.32	0.05	9716.37	1367	
1368	2086350.339	417457.992	9752.66	0.05	9752.71	1368	
1369	2086351.580	408850.323	8717.75	-0.22	8717.53	1369	
1370	2086360.523	407785.671	8910.69	0.01	8910.70	1370	
1371	2086367.216	407274.805	9065.41	0.16	9065.57	1371	
1372	2086370.383	416263.066	9041.48	0.00	9041.48	1372	
1373	2086378.844	410266.821	9330.92	0.28	9331.20	1373	
1374	2086382.350	416458.368	9210.45	-0.84	9209.61	1374	
1375	2086399.029	413710.900	9423.11	-0.03	9423.08	1375	
1376	2086413.631	411090.210	9164.90	-0.15	9164.75	1376	
1377	2086421.258	413008.660	9228.93	-0.06	9228.87	1377	
1378	2086441.732	415292.056	9468.97	-0.56	9468.41	1378	
1379	2086454.266	407597.640	9029.79	0.01	9029.80	1379	
1380	2086465.783	416856.105	9474.65	-0.06	9474.59	1380	
1381	2086471.540	418122.833	9441.50	0.04	9441.54	1381	
1383	2086479.295	409910.633	9207.25	1.15	9208.40	1383	
1384	2086496.747	414792.288	9592.29	-0.09	9592.20	1384	
1385	2086503.385	414082.248	9562.17	-0.02	9562.15	1385	
1386	2086520.899	412263.280	8673.68	0.31	8673.99	1386	
1387	2086530.645	418875.103	9405.08	0.30	9405.38	1387	
1388	2086541.350	413368.569	9275.24	-1.26	9273.98	1388	
1389	2086554.851	410711.714	9327.13	-0.70	9326.43	1389	
1390	2086573.944	409143.048	8681.47	-0.10	8681.37	1390	
1391	2086576.603	416004.785	9037.58	-0.20	9037.38	1391	

POINT	EASTING	NORTHING	1995	2001 STUDY ELEVATION	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION			BASE ELEVATION		
1392	2086587.951	418517.599	9218.62	-0.88	9217.74	1392		
1393	2086590.151	411494.115	8864.69	-0.13	8864.56	1393		
1394	2086594.484	409521.522	8839.63	-0.36	8839.27	1394		
1395	2086599.624	413551.857	9268.69	-0.12	9268.57	1395		
1396	2086607.136	414318.419	9676.44	-0.93	9675.51	1396		
1397	2086650.547	413907.010	9452.77	-0.39	9452.38	1397		
1398	2086659.841	412522.355	8793.38	-1.07	8792.31	1398		
1399	2086662.619	415657.692	9164.55	-0.15	9164.40	1399		
1400	2086663.788	410178.504	9176.12	-0.89	9175.23	1400		
1401	2086668.039	417572.559	9692.07	0.08	9692.15	1401		
1402	2086678.559	417731.027	9653.69	-0.10	9653.59	1402		
1403	2086685.426	417205.672	9631.75	-0.01	9631.74	1403		
1404	2086717.787	414988.379	9477.27	-0.12	9477.15	1404		
1405	2086719.849	416248.704	9056.45	0.10	9056.55	1405		
1407	2086739.593	408527.792	8794.10	0.06	8794.16	1407		
1408	2086749.315	407579.464	9143.28	-0.08	9143.20	1408		
1409	2086766.705	414571.508	9680.89	-0.04	9680.85	1409		
1410	2086782.513	407852.835	9004.76	-0.01	9004.75	1410		
1411	2086793.307	408219.955	8918.39	-0.07	8918.32	1411		
1412	2086806.539	415291.258	9327.09	0.00	9327.09	1412		
1413	2086813.620	412928.901	8909.36	-0.02	8909.34	1413		
1414	2086814.120	412121.240	8583.31	-0.88	8582.43	1414		
1415	2086828.379	410783.818	9298.57	-2.00	9296.57	1415		
1416	2086846.592	417432.090	9654.74	0.20	9654.94	1416		
1417	2086857.764	418853.024	9274.55	0.42	9274.97	1417		
1418	2086869.446	418016.409	9471.80	0.26	9472.06	1418		
1419	2086879.115	409035.470	8661.22	-0.30	8660.92	1419		
1420	2086882.224	413423.003	9185.95	0.08	9186.03	1420		
1421	2086891.514	411236.878	9028.94	-0.03	9028.91	1421		
1422	2086896.053	413733.339	9346.98	0.01	9346.99	1422		
1423	2086897.215	416506.228	9176.91	-0.73	9176.18	1423		
1424	2086905.668	409892.692	8839.72	0.22	8839.94	1424		
1425	2086935.492	409481.380	8707.79	-0.13	8707.66	1425		
1426	2086959.164	416942.663	9509.16	-0.02	9509.14	1426		
1427	2086976.137	414088.959	9544.71	-0.31	9544.40	1427		
1428	2086977.232	415105.449	9439.28	0.40	9439.68	1428		
1429	2086985.855	410281.528	8915.02	-0.12	8914.90	1429		
1430	2087008.500	418555.015	9113.88	0.03	9113.91	1430		
1431	2087012.206	410550.628	9160.30	-0.08	9160.22	1431		
1432	2087018.457	410871.502	9244.99	-0.02	9244.97	1432		
1433	2087039.975	415835.532	8966.56	-0.17	8966.39	1433		
1434	2087060.465	412619.813	8700.40	-2.76	8697.64	1434		
1435	2087109.563	413418.661	9222.74	-0.46	9222.28	1435		
1436	2087110.310	414694.096	9555.50	0.06	9555.56	1436		
1437	2087112.368	416152.178	8957.00	-0.85	8956.15	1437		
1438	2087160.828	417677.457	9620.00	0.06	9620.06	1438		
1439	2087170.940	412104.695	8534.95	0.81	8535.76	1439		
1440	2087181.697	418624.738	9044.70	-0.18	9044.52	1440		
1441	2087186.378	419081.910	9240.32	0.16	9240.48	1441		
1442	2087188.691	410839.087	9210.07	0.14	9210.21	1442		

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1443	2087190.374	409474.372	8611.78	-0.10	8611.68	1443	
1444	2087196.488	417195.500	9409.83	-0.22	9409.61	1444	
1445	2087198.920	415432.261	9167.32	-0.04	9167.28	1445	
1446	2087218.712	413068.956	8975.00	-0.10	8974.90	1446	
1447	2087235.551	408153.168	9167.27	-0.02	9167.25	1447	
1448	2087238.405	409832.556	8647.90	0.09	8647.99	1448	
1449	2087258.256	411142.682	8989.04	-0.87	8988.17	1449	
1450	2087262.133	418006.967	9448.24	-0.02	9448.22	1450	
1451	2087279.784	409144.181	8652.83	-0.82	8652.01	1451	
1452	2087280.622	414397.735	9657.98	-0.71	9657.27	1452	
1453	2087302.909	407880.794	9256.09	0.06	9256.15	1453	
1454	2087323.178	416869.653	9228.87	0.13	9229.00	1454	
1455	2087331.474	410581.760	8916.05	-0.62	8915.43	1455	
1456	2087335.753	412796.965	8866.75	-3.38	8863.37	1456	
1457	2087339.561	410185.481	8721.03	-0.04	8720.99	1457	
1458	2087347.036	416478.286	9042.23	-0.24	9041.99	1458	
1459	2087386.697	414008.244	9518.69	-0.08	9518.61	1459	
1460	2087391.601	411947.409	8519.59	-0.43	8519.16	1460	
1461	2087410.177	415784.156	8950.51	-0.02	8950.49	1461	
1462	2087437.826	411407.449	8765.49	-0.04	8765.45	1462	
1463	2087443.087	408472.073	8886.53	-0.10	8886.43	1463	
1465	2087458.956	412401.917	8646.84	-2.64	8644.20	1465	
1467	2087475.164	416196.980	8849.50	0.62	8850.12	1467	
1468	2087482.967	410954.357	9022.27	0.02	9022.29	1468	
1469	2087489.645	413639.245	9351.28	-0.16	9351.12	1469	
1470	2087504.657	408778.199	8726.26	-0.58	8725.68	1470	
1471	2087530.851	417701.429	9592.98	0.08	9593.06	1471	
1472	2087532.234	409359.589	8597.37	-0.11	8597.26	1472	
1473	2087534.442	414737.682	9529.29	0.10	9529.39	1473	
1474	2087534.447	409980.753	8568.87	-0.38	8568.49	1474	
1475	2087543.893	409030.638	8708.59	-0.01	8708.58	1475	
1476	2087544.143	409632.031	8568.82	0.15	8568.97	1476	
1478	2087553.765	413156.388	9220.34	0.05	9220.39	1478	
1479	2087564.268	415085.749	9408.46	0.03	9408.49	1479	
1480	2087566.355	418553.679	9093.33	-0.05	9093.28	1480	
1481	2087569.360	414206.583	9635.41	-0.44	9634.97	1481	
1482	2087571.901	415329.246	9258.56	0.06	9258.62	1482	
1483	2087572.908	414346.182	9670.49	0.16	9670.65	1483	
1484	2087574.710	410579.301	8776.57	0.03	8776.60	1484	
1485	2087581.094	417276.219	9351.31	-0.29	9351.02	1485	
1486	2087592.729	410306.566	8658.32	-0.22	8658.10	1486	
1487	2087616.632	416853.317	9054.68	0.04	9054.72	1487	
1488	2087617.739	416510.372	8936.44	-0.41	8936.03	1488	
1489	2087638.873	419010.214	9022.28	-0.09	9022.19	1489	
1490	2087667.322	412047.102	8474.72	-0.53	8474.19	1490	
1491	2087671.669	412644.001	8791.50	-0.15	8791.35	1491	
1492	2087717.836	415636.696	9027.06	0.05	9027.11	1492	
1493	2087747.742	411667.227	8541.74	0.25	8541.99	1493	
1494	2087750.506	419238.758	9085.61	-0.11	9085.50	1494	
1496	2087768.004	415014.365	9383.29	0.18	9383.47	1496	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1497	2087771.545	417416.395	9397.99	-0.19	9397.80	1497	
1498	2087795.009	416823.135	9005.84	0.06	9005.90	1498	
1499	2087795.632	418554.775	9085.30	-0.34	9084.96	1499	
1500	2087800.649	415970.703	8860.17	0.16	8860.33	1500	
1502	2087818.907	411251.973	8676.63	-0.39	8676.24	1502	
1503	2087822.240	417955.044	9465.73	0.03	9465.76	1503	
1504	2087832.070	408664.412	8903.11	0.01	8903.12	1504	
1505	2087841.083	414490.402	9624.36	0.09	9624.45	1505	
1506	2087852.499	412326.635	8635.65	-0.33	8635.32	1506	
1507	2087853.806	409923.446	8504.94	-0.05	8504.89	1507	
1508	2087855.130	413564.997	9423.42	-1.85	9421.57	1508	
1509	2087866.637	409644.703	8586.99	-0.07	8586.92	1509	
1510	2087873.631	410913.709	8764.36	0.05	8764.41	1510	
1511	2087884.694	412938.439	9032.91	-0.42	9032.49	1511	
1512	2087901.227	413179.165	9208.58	-0.31	9208.27	1512	
1513	2087912.594	414276.753	9680.67	-0.94	9679.73	1513	
1515	2087928.479	410510.873	8585.17	-0.14	8585.03	1515	
1516	2087932.852	414801.461	9464.47	-0.31	9464.16	1516	
1517	2087939.004	413923.144	9612.74	-0.13	9612.61	1517	
1518	2087946.779	412093.475	8536.82	-0.22	8536.60	1518	
1519	2087946.990	418759.482	8986.99	-0.03	8986.96	1519	
1520	2087985.922	409074.223	8932.41	-0.07	8932.34	1520	
1522	2088012.132	409266.595	8822.11	0.06	8822.17	1522	
1523	2088045.638	417122.710	9069.19	0.99	9070.18	1523	
1524	2088064.228	410336.471	8465.32	-0.01	8465.31	1524	
1525	2088079.605	415188.986	9374.47	-0.95	9373.52	1525	
1526	2088101.564	414227.916	9720.51	-1.13	9719.38	1526	
1527	2088110.106	419245.851	8961.38	0.21	8961.59	1527	
1528	2088119.238	417668.291	9419.54	-0.34	9419.20	1528	
1530	2088134.663	413541.723	9419.99	-0.15	9419.84	1530	
1531	2088137.077	412603.615	8828.82	-0.33	8828.49	1531	
1532	2088138.742	411681.195	8389.84	-0.40	8389.44	1532	
1533	2088148.054	418831.533	8957.82	0.06	8957.88	1533	
1534	2088167.536	412017.666	8531.64	-0.21	8531.43	1534	
1535	2088173.046	417844.766	9518.18	0.56	9518.74	1535	
1536	2088174.427	409981.049	8487.28	-0.56	8486.72	1536	
1537	2088175.658	410694.793	8501.90	-0.69	8501.21	1537	
1538	2088184.571	413999.882	9650.47	-1.51	9648.96	1538	
1539	2088191.587	416200.179	8787.65	-0.08	8787.57	1539	
1540	2088198.982	418558.991	9084.45	-0.13	9084.32	1540	
1542	2088228.630	414939.905	9497.80	-0.72	9497.08	1542	
1543	2088230.331	416531.424	8735.65	-1.25	8734.40	1543	
1544	2088235.429	414522.951	9641.34	-0.64	9640.70	1544	
1545	2088239.426	415894.522	8948.68	0.05	8948.73	1545	
1546	2088240.327	416870.028	8888.91	-0.40	8888.51	1546	
1547	2088259.512	415475.348	9293.46	-0.79	9292.67	1547	
1548	2088259.659	412326.419	8676.54	0.45	8676.99	1548	
1549	2088273.657	411236.206	8484.63	-0.07	8484.56	1549	
1551	2088305.253	418058.509	9448.43	0.18	9448.61	1551	
1552	2088319.773	412725.537	8884.18	-1.20	8882.98	1552	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1556	2088376.439	417412.395	9174.76	-0.02	9174.74	1556	
1557	2088376.767	419224.829	8835.04	-0.60	8834.44	1557	
1558	2088376.785	415161.378	9453.10	0.40	9453.50	1558	
1559	2088388.805	413412.006	9311.18	-1.65	9309.53	1559	
1561	2088426.230	414236.262	9749.60	-0.37	9749.23	1561	
1563	2088429.005	417628.015	9368.77	0.01	9368.78	1563	
1564	2088430.497	413046.604	9110.30	-0.29	9110.01	1564	
1566	2088439.212	411473.379	8377.79	-0.31	8377.48	1566	
1567	2088439.499	418859.932	8945.90	-0.63	8945.27	1567	
1571	2088520.323	412135.186	8702.13	-3.40	8698.73	1571	
1572	2088546.862	417099.006	8952.12	0.25	8952.37	1572	
1574	2088588.122	415742.701	9028.99	0.01	9029.00	1574	
1575	2088603.701	416138.282	8799.70	0.13	8799.83	1575	
1576	2088612.274	416350.568	8701.22	-0.13	8701.09	1576	
1577	2088620.282	416721.525	8744.99	-0.80	8744.19	1577	
1578	2088659.932	414516.565	9617.56	-0.45	9617.11	1578	
1579	2088662.752	414266.507	9703.18	-0.62	9702.56	1579	
1580	2088669.174	417601.335	9217.56	-1.79	9215.77	1580	
1581	2088680.060	415170.926	9379.56	0.03	9379.59	1581	
1582	2088700.555	417889.665	9405.51	-0.13	9405.38	1582	
1583	2088712.963	413999.391	9625.34	-0.42	9624.92	1583	
1584	2088716.869	414899.859	9449.63	-0.18	9449.45	1584	
1585	2088722.561	419103.545	8856.55	0.12	8856.67	1585	
1586	2088727.307	413716.660	9517.04	-0.25	9516.79	1586	
1587	2088727.433	412808.787	9195.66	-3.53	9192.13	1587	
1588	2088739.601	413445.462	9396.11	-0.02	9396.09	1588	
1589	2088748.034	417402.152	9053.54	-0.22	9053.32	1589	
1590	2088749.462	412392.181	8896.95	-0.99	8895.96	1590	
1591	2088761.770	418088.678	9430.61	0.19	9430.80	1591	
1592	2088764.425	413106.692	9304.11	-0.64	9303.47	1592	
1593	2088775.638	411154.602	8314.81	0.00	8314.81	1593	
1594	2088833.931	410771.325	8424.61	0.11	8424.72	1594	
1595	2088836.637	416487.265	8585.51	0.08	8585.59	1595	
1597	2088853.274	412110.961	8662.93	-0.68	8662.25	1597	
1599	2088855.373	411489.007	8332.43	-0.38	8332.05	1599	
1601	2088907.354	412487.953	8900.25	-4.56	8895.69	1601	
1602	2088918.266	419263.210	8813.47	-0.23	8813.24	1602	
1603	2088955.942	415196.139	9227.73	-0.48	9227.25	1603	
1604	2088956.850	413137.148	9283.45	-0.79	9282.66	1604	
1605	2088972.235	416369.287	8649.42	-0.14	8649.28	1605	
1606	2088978.406	415497.136	9081.34	-1.49	9079.85	1606	
1607	2088980.182	412919.449	9156.49	-2.61	9153.88	1607	
1608	2088985.256	417332.499	8946.67	-0.55	8946.12	1608	
1609	2088990.978	417859.382	9207.71	0.14	9207.85	1609	
1610	2088994.210	416695.632	8653.47	-2.24	8651.23	1610	
1611	2088995.713	414892.649	9367.80	0.01	9367.81	1611	
1612	2088998.677	415796.965	8910.65	0.16	8910.81	1612	
1613	2088998.707	416091.620	8763.48	-0.07	8763.41	1613	
1614	2089000.225	414590.398	9513.45	0.07	9513.52	1614	
1615	2089004.198	414312.787	9616.14	-0.14	9616.00	1615	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1617	2089010.515	414052.547	9585.43	0.31	9585.74	1617	
1618	2089013.483	419371.904	8787.88	-0.06	8787.82	1618	
1619	2089024.504	413456.562	9378.91	-0.73	9378.18	1619	
1620	2089034.898	416999.055	8764.16	-1.15	8763.01	1620	
1621	2089043.304	418237.369	9439.85	-1.07	9438.78	1621	
1622	2089052.619	410689.557	8526.40	-0.37	8526.03	1622	
1623	2089059.619	413756.709	9426.53	-0.18	9426.35	1623	
1624	2089103.758	411539.667	8312.60	-0.28	8312.32	1624	
1626	2089219.869	418973.487	9012.50	0.12	9012.62	1626	
1628	2089277.473	413989.493	9460.42	-0.06	9460.36	1628	
1629	2089294.561	416369.807	8644.08	-0.15	8643.93	1629	
1630	2089296.528	412943.995	9181.60	-2.73	9178.87	1630	
1631	2089298.700	415254.106	9274.08	-0.10	9273.98	1631	
1632	2089299.515	412246.533	8629.08	-0.18	8628.90	1632	
1633	2089301.253	413723.408	9342.11	-0.29	9341.82	1633	
1634	2089302.401	413449.529	9226.14	0.16	9226.30	1634	
1635	2089304.934	413117.119	9180.82	-1.45	9179.37	1635	
1636	2089305.560	414264.568	9589.12	-0.56	9588.56	1636	
1637	2089308.183	418229.730	9283.38	0.26	9283.64	1637	
1638	2089308.230	411933.444	8471.67	-0.63	8471.04	1638	
1639	2089309.113	414544.194	9580.41	-0.80	9579.61	1639	
1640	2089319.693	417516.444	8904.59	-0.79	8903.80	1640	
1641	2089326.455	414932.218	9413.61	-1.03	9412.58	1641	
1642	2089327.813	416526.367	8581.07	0.81	8581.88	1642	
1643	2089339.415	412447.842	8765.23	-0.14	8765.09	1643	
1644	2089346.577	414416.514	9611.18	-0.33	9610.85	1644	
1645	2089367.738	416855.299	8599.37	0.11	8599.48	1645	
1646	2089379.271	417232.294	8737.83	-1.69	8736.14	1646	
1647	2089387.082	418426.036	9389.80	-0.92	9388.88	1647	
1648	2089387.834	417804.111	9004.27	-0.20	9004.07	1648	
1649	2089403.223	419192.477	8946.93	-0.10	8946.83	1649	
1650	2089406.719	416021.787	8852.66	0.37	8853.03	1650	
1651	2089431.061	415652.290	9081.08	-0.15	9080.93	1651	
1652	2089436.271	411334.855	8307.31	-0.16	8307.15	1652	
1653	2089484.349	411060.777	8432.43	-0.04	8432.39	1653	
1654	2089495.381	410643.491	8643.41	0.08	8643.49	1654	
1655	2089528.940	415012.308	9425.79	-0.68	9425.11	1655	
1656	2089553.297	412806.380	8883.96	0.01	8883.97	1656	
1657	2089571.815	410314.933	8866.34	0.24	8866.58	1657	
1658	2089572.350	417578.741	8830.80	-2.44	8828.36	1658	
1659	2089574.804	412108.412	8526.45	0.16	8526.61	1659	
1660	2089576.654	418467.734	9339.10	-0.68	9338.42	1660	
1661	2089583.559	417881.264	8964.62	-0.69	8963.93	1661	
1662	2089592.312	414011.137	9449.60	-0.08	9449.52	1662	
1663	2089595.198	411675.161	8309.42	0.02	8309.44	1663	
1664	2089596.395	413412.705	9154.35	-0.73	9153.62	1664	
1665	2089597.648	416986.888	8566.78	-1.54	8565.24	1665	
1666	2089598.344	414683.048	9583.39	-1.42	9581.97	1666	
1667	2089600.573	413093.472	8939.48	0.45	8939.93	1667	
1668	2089600.577	416089.091	8786.65	-0.41	8786.24	1668	

POINT	EASTING	NORTHING	1995	2001	2001	POINT	COMMENTS
			STUDY ELEVATION	2001 DIFFERENCE	BASE ELEVATION		
1669	2089603.375	418245.340	9163.49	-0.21	9163.28	1669	
1670	2089603.824	412506.335	8726.62	-0.28	8726.34	1670	
1671	2089607.254	417190.321	8638.31	-2.70	8635.61	1671	
1672	2089609.095	413703.210	9296.95	-0.05	9296.90	1672	
1673	2089610.122	414491.419	9622.45	-0.62	9621.83	1673	
1674	2089613.841	415806.467	8953.64	0.16	8953.80	1674	
1675	2089615.888	418570.328	9394.07	-1.08	9392.99	1675	
1676	2089617.164	416628.178	8559.46	-0.88	8558.58	1676	
1677	2089617.362	415352.940	9237.22	-0.75	9236.47	1677	
1678	2089624.560	416388.679	8641.78	0.09	8641.87	1678	
1679	2089630.817	414250.750	9571.34	-0.59	9570.75	1679	
1681	2089720.168	419221.215	9022.99	-0.21	9022.78	1681	
1682	2089751.237	410955.796	8484.65	0.40	8485.05	1682	
1683	2089771.494	410617.720	8676.03	-0.04	8675.99	1683	
1684	2089786.737	413781.544	9297.67	-3.43	9294.24	1684	
1685	2089831.304	410426.959	8783.58	0.14	8783.72	1685	
1686	2089835.616	412012.319	8409.96	-1.86	8408.10	1686	
1687	2089851.473	418450.855	9147.81	-0.15	9147.66	1687	
1688	2089851.930	417283.698	8624.80	-3.43	8621.37	1688	
1689	2089873.730	417573.935	8723.96	-3.68	8720.28	1689	
1690	2089882.314	411605.237	8218.76	0.04	8218.80	1690	
1691	2089887.868	412900.811	8733.65	-0.03	8733.62	1691	
1692	2089889.902	414004.447	9404.89	-1.56	9403.33	1692	
1693	2089893.457	415499.671	9160.74	-1.10	9159.64	1693	
1694	2089897.602	416423.349	8663.64	0.01	8663.65	1694	
1695	2089899.131	417909.697	8871.91	-2.62	8869.29	1695	
1696	2089903.384	418210.356	8985.90	-0.08	8985.82	1696	
1697	2089907.523	416985.704	8481.91	-2.75	8479.16	1697	
1698	2089908.228	415075.939	9372.01	-3.13	9368.88	1698	
1699	2089914.275	412485.531	8557.36	-0.33	8557.03	1699	
1700	2089918.034	414699.463	9578.79	-3.02	9575.77	1700	
1701	2089922.413	414521.686	9614.26	-2.47	9611.79	1701	
1702	2089927.811	413109.713	8853.28	0.56	8853.84	1702	
1703	2089928.832	414304.255	9567.42	-1.18	9566.24	1703	
1704	2089930.623	415799.972	9005.47	0.04	9005.51	1704	
1705	2089933.532	416088.808	8869.83	-1.48	8868.35	1705	
1706	2089934.442	418784.879	9354.58	-0.68	9353.90	1706	
1707	2089939.551	416698.987	8549.49	-3.54	8545.95	1707	
1708	2089951.281	412226.814	8452.11	-0.07	8452.04	1708	
1709	2089981.822	413510.982	9149.92	-1.79	9148.13	1709	
1710	2090073.489	410345.998	8750.61	0.30	8750.91	1710	
1711	2090079.115	419085.006	9206.31	-1.52	9204.79	1711	
1712	2090106.106	418775.661	9200.74	-3.69	9197.05	1712	
1713	2090112.032	410603.144	8617.16	-0.14	8617.02	1713	
1715	2090139.423	413165.151	8928.79	-3.54	8925.25	1715	
1716	2090171.408	412895.676	8791.93	-2.76	8789.17	1716	
1717	2090171.780	410883.750	8476.72	-0.20	8476.52	1717	
1718	2090172.586	415391.971	9336.25	-0.09	9336.16	1718	
1719	2090184.306	417890.864	8731.96	-2.89	8729.07	1719	
1720	2090187.703	413471.937	9161.32	-1.75	9159.57	1720	

POINT	EASTING	NORTHING	1995	2001 STUDY ELEVATION	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION			BASE ELEVATION		
1825	2091333.641	413040.386	9143.52	-3.91	9139.61	1825		
1826	2091338.548	418811.829	8653.70	-4.22	8649.48	1826		
1827	2091341.598	410590.705	8393.70	-0.04	8393.66	1827		
1828	2091349.792	418492.846	8522.47	-4.26	8518.21	1828		
1829	2091353.447	411915.288	8366.60	0.25	8366.85	1829		
1830	2091357.140	419097.199	8772.18	-3.25	8768.93	1830		
1831	2091362.766	413223.613	9219.70	-4.57	9215.13	1831		
1832	2091367.963	413428.212	9275.60	-2.53	9273.07	1832		
1833	2091369.463	411233.192	8091.24	-0.02	8091.22	1833		
1834	2091379.986	415566.413	9333.36	-0.84	9332.52	1834		
1835	2091381.711	416082.517	9059.60	0.12	9059.72	1835		
1836	2091389.098	418147.616	8383.85	-6.97	8376.88	1836		
1837	2091398.552	417897.562	8313.43	-5.24	8308.19	1837		
1838	2091408.418	416396.489	8859.72	-0.66	8859.06	1838		
1839	2091416.878	416657.011	8742.08	-0.65	8741.43	1839		
1840	2091422.202	409865.402	8687.43	-0.31	8687.12	1840		
1841	2091427.910	417258.294	8506.71	-4.83	8501.88	1841		
1842	2091446.109	415778.756	9290.09	-0.22	9289.87	1842		
1843	2091483.389	417631.580	8312.87	-0.40	8312.47	1843		
1844	2091486.220	417032.072	8613.73	-1.62	8612.11	1844		
1845	2091542.562	412212.780	8509.20	-0.02	8509.18	1845		
1846	2091543.871	414924.686	9644.36	-0.84	9643.52	1846		
1847	2091545.416	414704.487	9699.58	-0.23	9699.35	1847		
1848	2091565.419	412534.900	8697.33	0.10	8697.43	1848		
1849	2091566.992	413423.295	9245.82	0.54	9246.36	1849		
1850	2091570.565	415557.123	9371.92	-0.48	9371.44	1850		
1851	2091585.018	414492.302	9727.80	-1.00	9726.80	1851		
1852	2091592.464	416154.370	9077.97	-0.41	9077.56	1852		
1853	2091599.645	414091.091	9550.62	-0.60	9550.02	1853		
1854	2091614.916	415259.168	9506.51	0.16	9506.67	1854		
1855	2091668.147	413847.484	9422.88	-1.49	9421.39	1855		
1856	2091670.419	413189.029	9099.45	-0.74	9098.71	1856		
1857	2091687.240	412280.404	8557.73	-0.10	8557.63	1857		
1858	2091687.754	418479.997	8389.08	-5.27	8383.81	1858		
1859	2091695.055	417874.375	8201.98	0.16	8202.14	1859		
1860	2091695.714	418766.271	8523.54	-4.86	8518.68	1860		
1861	2091696.810	415821.537	9303.24	-1.01	9302.23	1861		
1862	2091698.947	418194.120	8255.29	-1.54	8253.75	1862		
1863	2091700.136	417591.707	8381.49	-0.24	8381.25	1863		
1864	2091700.287	417293.957	8534.35	-5.10	8529.25	1864		
1865	2091716.848	410245.201	8420.29	0.35	8420.64	1865		
1866	2091740.605	411410.277	8217.35	-0.11	8217.24	1866		
1867	2091764.929	411755.643	8398.32	-0.18	8398.14	1867		
1868	2091780.722	409969.446	8511.69	-0.06	8511.63	1868		
1869	2091796.875	411077.903	8081.74	0.06	8081.80	1869		
1870	2091799.254	411975.840	8485.93	0.01	8485.94	1870		
1871	2091821.232	410676.845	8208.49	-0.32	8208.17	1871		
1872	2091852.003	415249.143	9506.41	-0.01	9506.40	1872		
1873	2091857.999	413522.937	9225.38	-0.38	9225.00	1873		
1874	2091858.858	416763.636	8839.83	-0.77	8839.06	1874		

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
1875	2091862.400	417048.765	8677.18	-0.35	8676.83	1875	
1876	2091868.203	418843.725	8484.11	1.31	8485.42	1876	
1877	2091872.375	419092.807	8571.17	-0.81	8570.36	1877	
1878	2091874.490	414963.523	9561.21	-0.77	9560.44	1878	
1879	2091878.500	415812.579	9362.65	-1.01	9361.64	1879	
1881	2091885.498	412896.043	8915.87	4.06	8919.93	1881	
1882	2091889.133	415556.622	9404.18	-1.19	9402.99	1882	
1883	2091897.431	417659.706	8377.39	-0.33	8377.06	1883	
1884	2091897.486	416136.206	9275.60	-0.48	9275.12	1884	
1885	2091898.086	414681.578	9586.56	-1.01	9585.55	1885	
1886	2091918.240	418379.225	8263.01	0.73	8263.74	1886	
1887	2091919.894	413281.945	9121.44	0.01	9121.45	1887	
1888	2091920.842	414100.638	9541.67	-2.63	9539.04	1888	
1889	2091924.586	418601.660	8372.93	-0.62	8372.31	1889	
1890	2091930.557	416508.274	9038.55	-0.35	9038.20	1890	
1891	2091940.919	414406.193	9652.53	-1.03	9651.50	1891	
1892	2091945.522	413841.779	9407.15	-1.79	9405.36	1892	
1893	2091986.513	417900.300	8289.94	-0.05	8289.89	1893	
1894	2092023.454	412562.598	8819.52	0.08	8819.60	1894	
1895	2092096.726	411598.650	8371.11	-0.29	8370.82	1895	
1896	2092134.566	418287.790	8159.84	-0.02	8159.82	1896	
1897	2092151.254	414300.354	9628.89	0.73	9629.62	1897	
1898	2092152.827	416732.554	8910.80	-0.29	8910.51	1898	
1899	2092153.060	410325.020	8266.07	-0.14	8265.93	1899	
1900	2092154.147	414661.828	9554.46	-0.01	9554.45	1900	
1901	2092161.489	416132.595	9309.05	-0.04	9309.01	1901	
1902	2092165.792	419144.920	8525.73	1.11	8526.84	1902	
1903	2092167.032	418846.667	8386.14	0.62	8386.76	1903	
1904	2092169.188	411923.535	8606.94	0.63	8607.57	1904	
1905	2092170.483	415853.677	9362.23	-0.49	9361.74	1905	
1906	2092171.916	411242.650	8243.30	0.02	8243.32	1906	
1907	2092173.902	415533.904	9365.66	-0.17	9365.49	1907	
1908	2092180.992	417341.561	8570.07	0.04	8570.11	1908	
1909	2092189.128	409962.283	8435.34	0.32	8435.66	1909	
1910	2092193.149	415236.636	9398.66	0.10	9398.76	1910	
1911	2092193.522	412996.335	9133.13	1.16	9134.29	1911	
1912	2092194.578	413583.919	9341.66	0.13	9341.79	1912	
1913	2092197.628	416373.804	9201.20	-0.18	9201.02	1913	
1914	2092197.647	413794.809	9439.05	-0.49	9438.56	1914	
1915	2092211.801	414931.782	9468.18	0.07	9468.25	1915	
1916	2092212.296	416996.293	8761.62	0.31	8761.93	1916	
1917	2092212.899	413378.886	9266.88	0.12	9267.00	1917	
1918	2092219.420	418550.607	8263.46	-0.13	8263.33	1918	
1919	2092227.215	412237.325	8779.82	-0.11	8779.71	1919	
1920	2092229.309	414069.143	9559.37	-0.17	9559.20	1920	
1921	2092280.802	417930.745	8290.07	-1.04	8289.03	1921	
1922	2092285.902	417935.845	8985.93	0.09	8986.02	1922	
1923	2092314.468	410848.433	8037.48	0.11	8037.59	1923	
1924	2092324.764	417659.667	8435.54	-0.31	8435.23	1924	
1925	2092407.267	417029.630	8803.92	0.02	8803.94	1925	

POINT	EASTING	NORTHING	1995	2001 BASE ELEVATION	POINT	COMMENTS
			STUDY ELEVATION			
1926	2092416.179	419147.424	8515.43	0.06	8515.49	1926
1927	2092439.825	418527.105	8204.47	0.00	8204.47	1927
1928	2092448.361	414655.667	9481.45	0.21	9481.66	1928
1929	2092449.926	411623.930	8520.85	0.35	8521.20	1929
1930	2092450.981	415845.645	9296.20	-0.54	9295.66	1930
1931	2092456.619	413786.146	9514.36	1.02	9515.38	1931
1932	2092458.837	412005.488	8693.43	-0.36	8693.07	1932
1933	2092463.034	418848.468	8323.40	2.64	8326.04	1933
1934	2092466.239	417651.519	8436.77	-0.06	8436.71	1934
1935	2092466.265	417936.866	8288.46	-0.09	8288.37	1935
1936	2092467.234	418295.537	8088.06	1.24	8089.30	1936
1937	2092468.819	413442.375	9380.44	1.39	9381.83	1937
1938	2092470.103	417346.348	8607.40	0.11	8607.51	1938
1939	2092471.694	414356.063	9559.89	0.45	9560.34	1939
1940	2092473.299	416129.922	9318.28	-0.47	9317.81	1940
1941	2092474.010	414975.820	9366.56	0.00	9366.56	1941
1942	2092474.864	416728.358	8992.60	-0.29	8992.31	1942
1943	2092474.942	416457.501	9211.37	0.04	9211.41	1943
1944	2092475.505	413191.305	9317.67	1.17	9318.84	1944
1945	2092476.563	415529.753	9263.32	0.14	9263.46	1945
1946	2092482.793	415247.356	9299.39	-0.15	9299.24	1946
1947	2092499.312	414107.259	9606.93	0.36	9607.29	1947
1948	2092520.678	409938.962	8245.81	0.00	8245.81	1948
1949	2092563.564	412856.224	9264.55	-0.33	9264.22	1949
1950	2092592.396	411211.919	8289.19	0.09	8289.28	1950
1951	2092665.118	410314.767	8085.74	-0.63	8085.11	1951
1952	2092699.266	410875.245	8137.88	-0.38	8137.50	1952
1953	2092721.781	417649.030	8464.96	-0.01	8464.95	1953
1954	2092757.514	413146.422	9395.20	0.50	9395.70	1954
1955	2092768.683	418554.264	8132.20	1.75	8133.95	1955
1956	2092769.100	412328.215	9003.83	0.00	9003.83	1956
1957	2092770.199	414330.502	9515.23	0.63	9515.86	1957
1958	2092770.780	414053.567	9569.57	0.16	9569.73	1958
1959	2092771.964	419159.456	8481.33	1.06	8482.39	1959
1960	2092772.067	415260.372	9195.55	0.07	9195.62	1960
1961	2092772.758	415521.545	9158.54	0.31	9158.85	1961
1962	2092774.736	414942.953	9307.53	-0.42	9307.11	1962
1963	2092776.811	414649.642	9391.42	0.08	9391.50	1963
1964	2092777.189	416452.100	9234.42	0.14	9234.56	1964
1965	2092779.365	416746.038	9023.47	-0.57	9022.90	1965
1966	2092782.520	418868.190	8302.44	1.17	8303.61	1966
1967	2092782.799	413522.795	9526.56	0.24	9526.80	1967
1968	2092784.285	413869.573	9613.33	0.22	9613.55	1968
1969	2092789.244	417359.489	8629.97	0.07	8630.04	1969
1970	2092791.234	416255.319	9310.57	-0.19	9310.38	1970
1971	2092792.475	417062.767	8814.03	-0.26	8813.77	1971
1972	2092800.238	412922.755	9314.51	0.48	9314.99	1972
1973	2092801.060	418245.708	8144.79	-0.21	8144.58	1973
1974	2092821.927	415875.416	9198.84	0.43	9199.27	1974
1975	2092830.909	417964.133	8294.88	-1.14	8293.74	1975

POINT	EASTING	NORTHING	1995	2001 BASE ELEVATION	POINT	COMMENTS
			STUDY ELEVATION			
1976	2092873.457	412024.783	8836.66	0.00	8836.66	1976
1977	2092896.635	411642.244	8610.66	0.00	8610.66	1977
1978	2092914.291	409944.009	8102.96	-0.10	8102.86	1978
1979	2092969.815	410837.480	8145.28	0.00	8145.28	1979
1980	2092985.754	411235.727	8399.55	0.00	8399.55	1980
1981	2093033.677	419153.893	8391.82	0.68	8392.50	1981
1982	2093051.079	417058.981	8848.48	0.86	8849.34	1982
1983	2093067.449	413422.853	9501.27	0.24	9501.51	1983
1984	2093071.359	416174.494	9207.98	-0.04	9207.94	1984
1985	2093071.823	417947.222	8328.92	-0.33	8328.59	1985
1986	2093072.381	416442.731	9298.20	0.21	9298.41	1986
1987	2093074.701	414953.805	9229.48	0.30	9229.78	1987
1988	2093078.622	415170.292	9142.43	-0.13	9142.30	1988
1989	2093079.510	417355.600	8670.11	-0.06	8670.05	1989
1990	2093079.919	414322.268	9426.72	0.11	9426.83	1990
1991	2093080.945	413212.808	9400.16	-0.16	9400.00	1991
1992	2093081.059	414638.754	9343.34	0.17	9343.51	1992
1993	2093081.590	417653.217	8501.84	0.61	8502.45	1993
1994	2093081.702	412951.569	9290.11	0.32	9290.43	1994
1995	2093083.266	418165.592	8200.24	-1.24	8199.00	1995
1996	2093083.964	415844.224	9039.45	-0.25	9039.20	1996
1997	2093085.303	413729.209	9519.82	-0.18	9519.64	1997
1998	2093092.682	416741.030	9083.21	-1.11	9082.10	1998
1999	2093101.117	418840.160	8218.39	1.39	8219.78	1999
2000	2093103.138	418599.051	8080.89	2.66	8083.55	2000
2001	2093104.420	414079.475	9430.00	-0.18	9429.82	2001
2002	2093106.272	415467.819	8962.40	0.09	8962.49	2002
2003	2093180.365	410337.189	8032.22	0.00	8032.22	2003
2004	2093280.339	409975.159	8146.43	-0.01	8146.43	2004
2005	2093308.542	412067.340	8765.14	0.00	8765.14	2005
2006	2093309.537	413561.482	9483.80	1.82	9485.62	2006
2007	2093323.856	415858.602	8904.67	-0.01	8904.66	2007
2008	2093343.992	412385.467	8881.08	0.00	8881.08	2008
2009	2093355.807	418845.288	8116.99	0.07	8117.06	2009
2010	2093357.532	416158.626	9002.99	0.23	9003.22	2010
2011	2093358.667	419142.031	8228.01	2.64	8230.65	2011
2012	2093363.569	416561.821	9241.76	-0.59	9241.17	2012
2013	2093364.913	414424.197	9334.47	1.06	9335.53	2013
2014	2093370.246	417353.478	8688.96	-0.06	8688.90	2014
2015	2093370.365	416753.847	9102.39	-10.00	9092.39	2015
2016	2093370.673	418254.163	8197.75	-0.16	8197.59	2016
2017	2093370.980	417053.525	8875.86	-1.78	8874.08	2017
2018	2093371.073	417654.298	8521.34	-0.69	8520.65	2018
2019	2093372.973	411835.657	8645.91	0.00	8645.91	2019
2020	2093377.934	412891.744	9231.91	0.62	9232.53	2020
2021	2093378.110	414031.656	9324.12	-1.04	9323.08	2021
2022	2093386.094	417913.573	8390.40	0.14	8390.54	2022
2023	2093389.707	415512.101	8804.27	0.01	8804.28	2023
2024	2093390.717	413798.945	9353.72	-1.37	9352.35	2024
2025	2093392.234	418617.603	7987.60	0.25	7987.85	2025

POINT	EASTING	NORTHING	STUDY ELEVATION	1995	2001	BASE ELEVATION	POINT	COMMENTS
					2001 DIFFERENCE			
2026	2093409.757	410811.845	8132.33	0.00		8132.33	2026	
2027	2093418.940	415235.672	8912.98	0.01		8912.99	2027	
2028	2093442.274	411235.617	8355.64	0.00		8355.64	2028	
2029	2093452.755	411560.260	8523.50	-0.29		8523.21	2029	
2030	2093461.917	414545.759	9305.94	1.00		9306.94	2030	
2031	2093477.252	414881.404	9149.68	-0.09		9149.59	2031	
2032	2093564.743	413520.442	9399.39	-0.22		9399.17	2032	
2033	2093571.862	410660.243	7976.99	0.00		7976.99	2033	
2034	2093591.675	410346.587	7950.03	0.00		7950.03	2034	
2035	2093595.694	410945.632	8163.62	0.00		8163.62	2035	
2036	2093601.227	412095.560	8641.47	0.00		8641.47	2036	
2037	2093613.618	413146.542	9241.79	0.10		9241.89	2037	
2038	2093630.592	416421.293	9017.82	-0.33		9017.49	2038	
2039	2093638.196	412846.844	9114.84	0.35		9115.19	2039	
2040	2093648.007	417926.736	8362.50	-0.16		8362.34	2040	
2041	2093649.963	418667.168	7962.67	3.23		7965.90	2041	
2042	2093652.371	417645.907	8517.56	-0.59		8516.97	2042	
2043	2093664.584	413504.188	9363.84	0.45		9364.29	2043	
2044	2093665.347	418857.112	8079.66	1.76		8081.42	2044	
2045	2093667.681	412523.744	8873.22	0.00		8873.22	2045	
2046	2093669.057	418233.245	8228.91	0.26		8229.17	2046	
2047	2093670.467	417353.186	8690.09	0.05		8690.14	2047	
2048	2093670.800	413717.087	9304.39	0.42		9304.81	2048	
2049	2093671.211	411765.652	8497.00	0.00		8497.00	2049	
2050	2093671.577	414054.141	9158.32	-0.23		9158.09	2050	
2051	2093671.587	415241.263	8816.81	0.16		8816.97	2051	
2052	2093672.638	416612.828	9205.10	-0.26		9204.84	2052	
2053	2093677.843	415521.267	8694.86	-0.25		8694.61	2053	
2054	2093681.851	414921.600	8986.20	-0.11		8986.09	2054	
2055	2093683.488	415909.172	8753.57	-0.24		8753.33	2055	
2056	2093688.168	419126.054	8168.37	2.80		8171.17	2056	
2057	2093695.008	411496.007	8383.70	0.00		8383.70	2057	
2058	2093704.218	416152.733	8837.88	-0.92		8836.96	2058	
2059	2093754.915	414406.770	9121.36	0.54		9121.90	2059	
2060	2093772.279	414622.368	9150.05	0.58		9150.63	2060	
2061	2093773.464	410489.157	7902.83	0.00		7902.83	2061	
2062	2093779.021	417137.431	8818.76	-0.62		8818.14	2062	
2064	2093827.953	410840.081	8137.44	0.00		8137.44	2064	
2065	2093830.170	411226.468	8242.65	0.00		8242.65	2065	
2066	2093917.827	414715.361	8985.53	0.18		8985.71	2066	
2067	2093947.967	411534.948	8271.17	-0.21		8270.96	2067	
2068	2093948.027	412929.324	9113.22	1.04		9114.26	2068	
2069	2093961.689	413253.878	9263.26	1.58		9264.84	2069	
2070	2093962.747	415262.484	8694.86	0.82		8695.68	2070	
2071	2093965.021	412161.109	8623.16	-0.16		8623.00	2071	
2072	2093971.255	413429.424	9291.12	1.30		9292.42	2072	
2073	2093972.939	414949.529	8839.32	0.08		8839.40	2073	
2074	2093973.664	414000.731	9109.09	-0.12		9108.97	2074	
2075	2093976.897	413751.430	9168.84	-0.36		9168.48	2075	
2076	2093994.769	411139.435	8133.00	0.00		8133.00	2076	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
2077	2094004.049	412550.060	8858.52	0.00	8858.52	2077	
2078	2094022.478	411923.000	8512.25	-0.25	8512.00	2078	
2079	2094029.398	410730.564	7941.54	0.00	7941.54	2079	
2080	2094067.556	414286.497	8858.51	-0.29	8858.22	2080	
2081	2094156.598	410390.650	7962.40	0.00	7962.40	2081	
2082	2094230.098	411471.664	8303.88	-0.24	8303.64	2082	
2083	2094231.119	412147.536	8684.11	0.04	8684.15	2083	
2084	2094245.772	413351.172	9279.49	0.76	9280.25	2084	
2085	2094247.397	412793.961	9078.20	0.00	9078.20	2085	
2086	2094272.376	414956.856	8701.17	0.63	8701.80	2086	
2087	2094275.835	413916.422	8971.08	-0.09	8970.99	2087	
2088	2094284.439	415225.312	8588.48	0.00	8588.48	2088	
2089	2094290.025	413572.909	9221.26	-0.11	9221.15	2089	
2090	2094294.360	411815.424	8502.91	0.02	8502.93	2090	
2091	2094326.521	412437.556	8883.94	-0.14	8883.80	2091	
2093	2094340.846	414649.826	8700.59	-0.17	8700.42	2093	
2094	2094358.830	411106.713	8122.83	0.00	8122.83	2094	
2095	2094372.052	410828.595	7938.63	0.00	7938.63	2095	
2096	2094373.487	414343.031	8702.40	0.23	8702.63	2096	
2097	2094476.766	413581.295	9130.90	0.03	9130.93	2097	
2098	2094518.287	413321.514	9263.90	-0.46	9263.44	2098	
2099	2094529.387	413948.973	8892.58	0.19	8892.77	2099	
2100	2094540.412	411481.074	8387.44	-0.11	8387.33	2100	
2101	2094546.623	412151.639	8795.48	-0.25	8795.23	2101	
2102	2094569.415	411876.136	8630.79	-0.31	8630.48	2102	
2103	2094577.203	414960.711	8514.98	0.03	8515.01	2103	
2104	2094579.145	412499.555	9104.25	-0.28	9103.97	2104	
2105	2094583.443	414370.462	8616.91	-0.04	8616.87	2105	
2106	2094590.945	410664.194	7853.57	0.00	7853.57	2106	
2107	2094604.441	414711.967	8502.08	0.85	8502.93	2107	
2108	2094618.793	415251.548	8417.45	0.00	8417.45	2108	
2109	2094684.645	412811.619	9079.02	0.55	9079.57	2109	
2110	2094730.613	411271.643	8199.34	0.00	8199.34	2110	
2112	2094802.812	413854.108	8912.02	0.04	8912.06	2112	
2113	2094803.733	413549.750	9155.83	0.05	9155.88	2113	
2114	2094811.742	413322.922	9251.79	0.14	9251.93	2114	
2115	2094818.068	414489.473	8496.33	-0.13	8496.20	2115	
2116	2094828.828	414845.361	8346.95	0.04	8346.99	2116	
2117	2094829.869	414182.916	8684.05	0.11	8684.16	2117	
2118	2094833.176	410800.128	7859.24	0.00	7859.24	2118	
2119	2094852.063	411120.504	8058.54	0.00	8058.54	2119	
2120	2094864.480	415242.099	8295.46	-0.25	8295.21	2120	
2121	2094904.138	412558.289	8813.43	-0.43	8813.00	2121	
2122	2094924.796	412855.439	8937.17	0.16	8937.33	2122	
2123	2094933.029	411417.594	8267.43	0.01	8267.44	2123	
2124	2094953.568	411805.084	8574.52	0.07	8574.59	2124	
2125	2094999.032	412161.184	8678.17	-0.02	8678.15	2125	
2126	2095088.008	415285.972	8142.10	-0.06	8142.04	2126	
2127	2095098.603	413402.231	9227.60	-0.10	9227.50	2127	
2128	2095127.231	413619.940	9103.64	-0.40	9103.24	2128	

POINT	EASTING	NORTHING	1995	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION		BASE ELEVATION		
2129	2095138.856	413155.485	9068.20	-0.25	9067.95	2129	
2130	2095147.874	414321.778	8593.08	-0.05	8593.03	2130	
2131	2095164.424	414956.820	8226.57	0.42	8226.99	2131	
2132	2095168.222	411122.269	8034.87	0.01	8034.88	2132	
2133	2095177.921	414619.935	8407.68	-0.54	8407.14	2133	
2134	2095179.007	413936.301	8856.07	0.25	8856.32	2134	
2135	2095195.298	410849.418	7844.41	0.00	7844.41	2135	
2136	2095264.714	412050.379	8472.77	-0.64	8472.13	2136	
2137	2095298.662	411778.391	8377.21	-0.02	8377.19	2137	
2138	2095326.686	412981.314	8905.26	0.31	8905.57	2138	
2139	2095343.853	412428.869	8559.45	-0.19	8559.26	2139	
2140	2095344.088	411437.334	8141.36	-0.06	8141.30	2140	
2141	2095352.526	412699.966	8717.47	-0.16	8717.31	2141	
2142	2095370.566	413350.878	9232.59	0.02	9232.61	2142	
2143	2095404.916	411310.346	8048.92	0.25	8049.17	2143	
2144	2095424.985	413673.849	9073.23	-0.12	9073.11	2144	
2145	2095465.874	413999.920	8831.72	-0.17	8831.55	2145	
2146	2095481.194	410937.348	7803.16	-0.32	7802.84	2146	
2147	2095492.218	414330.742	8608.37	0.35	8608.72	2147	
2148	2095519.451	414798.776	8369.95	-0.01	8369.94	2148	
2149	2095639.445	411842.717	8228.84	0.03	8228.87	2149	
2150	2095653.860	412372.736	8468.15	0.09	8468.24	2150	
2151	2095662.321	412627.305	8630.73	-0.10	8630.63	2151	
2152	2095671.259	411536.877	8082.68	-0.02	8082.67	2152	
2153	2095672.619	413259.554	9128.54	0.06	9128.60	2153	
2154	2095681.474	412112.601	8302.04	-0.10	8301.94	2154	
2155	2095686.852	410993.540	7786.89	-0.12	7786.77	2155	
2156	2095711.439	415147.588	8166.45	0.13	8166.58	2156	
2157	2095724.034	413877.129	8980.48	0.39	8980.87	2157	
2158	2095727.634	412988.861	8852.97	0.09	8853.06	2158	
2159	2095733.971	413546.003	9210.90	0.02	9210.92	2159	
2160	2095742.560	411252.530	7896.27	-0.42	7895.85	2160	
2161	2095748.263	414655.791	8484.20	-0.73	8483.47	2161	
2162	2095770.992	414208.573	8731.71	-0.02	8731.69	2162	
2163	2095909.082	412694.781	8621.32	-0.17	8621.15	2163	
2164	2095935.044	412359.259	8417.21	-0.12	8417.09	2164	
2165	2095952.431	411658.740	8033.30	-0.12	8033.18	2165	
2166	2095978.688	411022.869	7758.87	0.40	7759.27	2166	
2167	2096022.059	412160.251	8294.97	-0.21	8294.76	2167	
2168	2096024.064	411277.121	7833.63	-0.03	7833.60	2168	
2169	2096026.896	412922.184	8733.92	1.58	8735.50	2169	
2170	2096045.919	414455.143	8542.39	-0.26	8542.13	2170	
2171	2096061.717	413265.525	8970.96	-0.16	8970.80	2171	
2172	2096064.096	414827.650	8323.30	0.04	8323.34	2172	
2173	2096070.686	413503.450	9163.71	-0.06	9163.65	2173	
2174	2096078.193	414140.532	8699.00	-0.03	8698.97	2174	
2175	2096085.441	415130.111	8139.07	-0.54	8138.53	2175	
2176	2096098.389	413809.044	8916.71	-0.17	8916.54	2176	
2177	2096308.832	411486.628	7899.15	-0.15	7899.00	2177	
2178	2096322.831	411759.199	8040.50	0.08	8040.58	2178	

POINT	EASTING	NORTHING	1995	2001 STUDY ELEVATION	2001 DIFFERENCE	2001	POINT	COMMENTS
			STUDY ELEVATION			BASE ELEVATION		
2179	2096346.729	414441.374	8484.84	-0.23	8484.61	2179		
2180	2096363.396	413887.091	8809.57	-0.26	8809.31	2180		
2181	2096366.466	411138.813	7733.84	0.00	7733.84	2181		
2182	2096388.246	412121.606	8234.11	0.32	8234.43	2182		
2183	2096396.753	413124.541	8993.41	-0.03	8993.38	2183		
2184	2096427.825	414149.404	8651.43	-0.36	8651.07	2184		
2185	2096428.557	415177.775	8091.96	-0.22	8091.74	2185		
2186	2096435.667	412444.283	8452.99	-0.10	8452.89	2186		
2187	2096454.961	413499.927	8817.23	0.29	8817.52	2187		
2188	2096462.188	414854.369	8279.78	-0.56	8279.22	2188		
2189	2096469.763	412846.823	8754.90	-0.38	8754.52	2189		
2190	2096641.775	412048.681	8152.97	-0.23	8152.74	2190		
2191	2096661.049	411670.999	7958.35	-0.12	7958.23	2191		
2192	2096675.304	413136.429	8813.92	-0.17	8813.75	2192		
2193	2096694.576	414343.550	8540.55	-0.08	8540.47	2193		
2194	2096724.413	414010.005	8569.53	0.07	8569.60	2194		
2195	2096742.663	412566.370	8482.63	0.24	8482.87	2195		
2196	2096852.542	414814.317	8288.32	-0.14	8288.18	2196		
2197	2096860.332	413563.479	8525.45	0.25	8525.70	2197		
2198	2097043.469	415225.866	8120.66	0.10	8120.76	2198		
2199	2097088.508	414145.518	8343.84	-0.09	8343.55	2199		
2200	2097156.112	411737.582	7897.16	-0.01	7897.15	2200		
2201	2097164.378	413194.448	8581.84	-0.06	8581.78	2201		
2202	2097172.689	412412.597	8238.34	-0.21	8238.13	2202		
2203	2097187.210	412055.173	7960.80	-0.06	7960.74	2203		
2204	2097208.321	412644.618	8301.25	-0.12	8301.13	2204		
2205	2097217.623	413848.672	8247.37	-0.32	8247.05	2205		
2206	2097222.505	412956.697	8438.01	0.04	8438.05	2206		
2207	2097224.737	413572.232	8384.38	0.15	8384.53	2207		
2208	2097238.073	414420.058	8223.08	0.06	8223.14	2208		
2209	2097245.433	4111415.830	7673.26	-0.16	7673.10	2209		
2210	2097269.419	414900.753	8033.79	0.13	8033.92	2210		
2211	2097373.819	411930.186	7906.74	-0.56	7906.18	2211		
2212	2097426.521	412948.889	8389.00	0.86	8389.86	2212		
2213	2097457.838	413489.295	8356.93	0.80	8357.73	2213		
2214	2097462.282	412549.946	8105.90	-0.13	8105.77	2214		
2215	2097473.369	412225.102	8010.76	0.03	8010.79	2215		
2216	2097480.359	413169.331	8501.32	0.06	8501.38	2216		
2217	2097488.599	414141.455	8076.06	0.17	8076.23	2217		
2218	2097495.771	413756.152	8194.32	-0.05	8194.27	2218		
2219	2097552.161	414466.820	8023.53	0.21	8023.74	2219		
2220	2097714.743	414905.863	7773.42	0.07	7773.49	2220		

Other Technical Data

No equipment or machinery was abandoned underground in 2001.

No known hazardous substances or waste oil in reportable quantities were left underground in 2000.

The Mine Map shows no locations of the above items due to their absence.

Mayo and Associates, LC
Consultants in Hydrogeology



31 March 2002

Mr. Gary Gray
GENWAL Resources, Inc.
P.O. Box 1420
Huntington, Utah 84528

Dear Gary,

At the request of GENWAL Resources, Inc., Mayo and Associates has produced this Annual Hydrologic Monitoring Report for the Crandall Canyon Mine for the year 2001. This report is based on hydrologic monitoring information collected by GENWAL Resources, Inc. and submitted to the Utah Division of Oil, Gas and Mining.

Other than the anticipated and permitted impacts to water quality and quantity in Crandall Creek resulting from the discharge of mine water, no mining-related impacts to water quality or water quantity at any of GENWAL's hydrologic monitoring points are evident.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Erik C. Petersen, P.G.
Senior Associate Hydrogeologist

**GENWAL Resources, Inc
Crandall Canyon Mine
2001 Annual Hydrologic Monitoring Report**

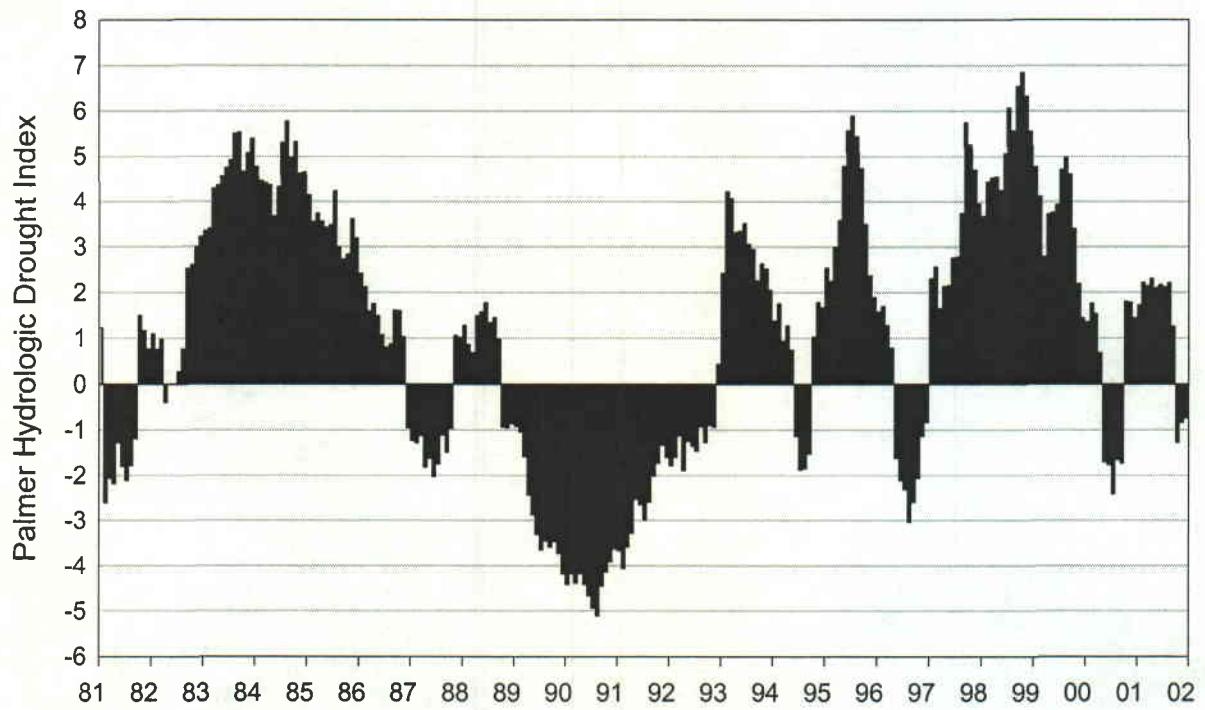
31 March 2002

At the request of GENWAL Resources, Inc., Mayo and Associates has produced this Annual Hydrologic Monitoring Report for the year 2001. This report is based on hydrologic monitoring information collected by GENWAL Resources, Inc. and submitted to the Utah Division of Oil, Gas and Mining.

No significant impacts to water quality or quantity were detected in any of the monitored springs, wells or creeks, with the exception of the anticipated and permitted impacts to water quality and quantity in Crandall Creek resulting from the discharge of mine water.

A plot of the Palmer Hydrologic Drought Index (PHDI) for Utah Region 4 is shown in Figure 1. The Year 2001 began with the region experiencing a period of moderate wetness. Beginning in mid-2001, the region experienced a period of gradual drying. By October, the region had entered a period of mild drought that persisted throughout the remainder of the year.

Spring and stream monitoring locations are shown on Figure 2. Locations for in-mine monitoring points are shown in the MRP. Graphs of discharge rates and important water quality parameters for each monitoring site are shown on the following pages. A brief summary of the results of the 2001 hydrologic monitoring for each monitoring site is also included.



-1 to -2 Mild Drought
-2 to -3 Moderate Drought
-3 to -4 Severe Drought
-4 to -5 Extreme Drought

1 to 2 Mild Wet Spell
2 to 3 Moderate Wet Spell
3 to 4 Severe Wet Spell
4 to 5 Extreme Wet Spell

Figure 1 Palmer Hydrologic Drought Index, Utah Region 4 (South Central Utah area).

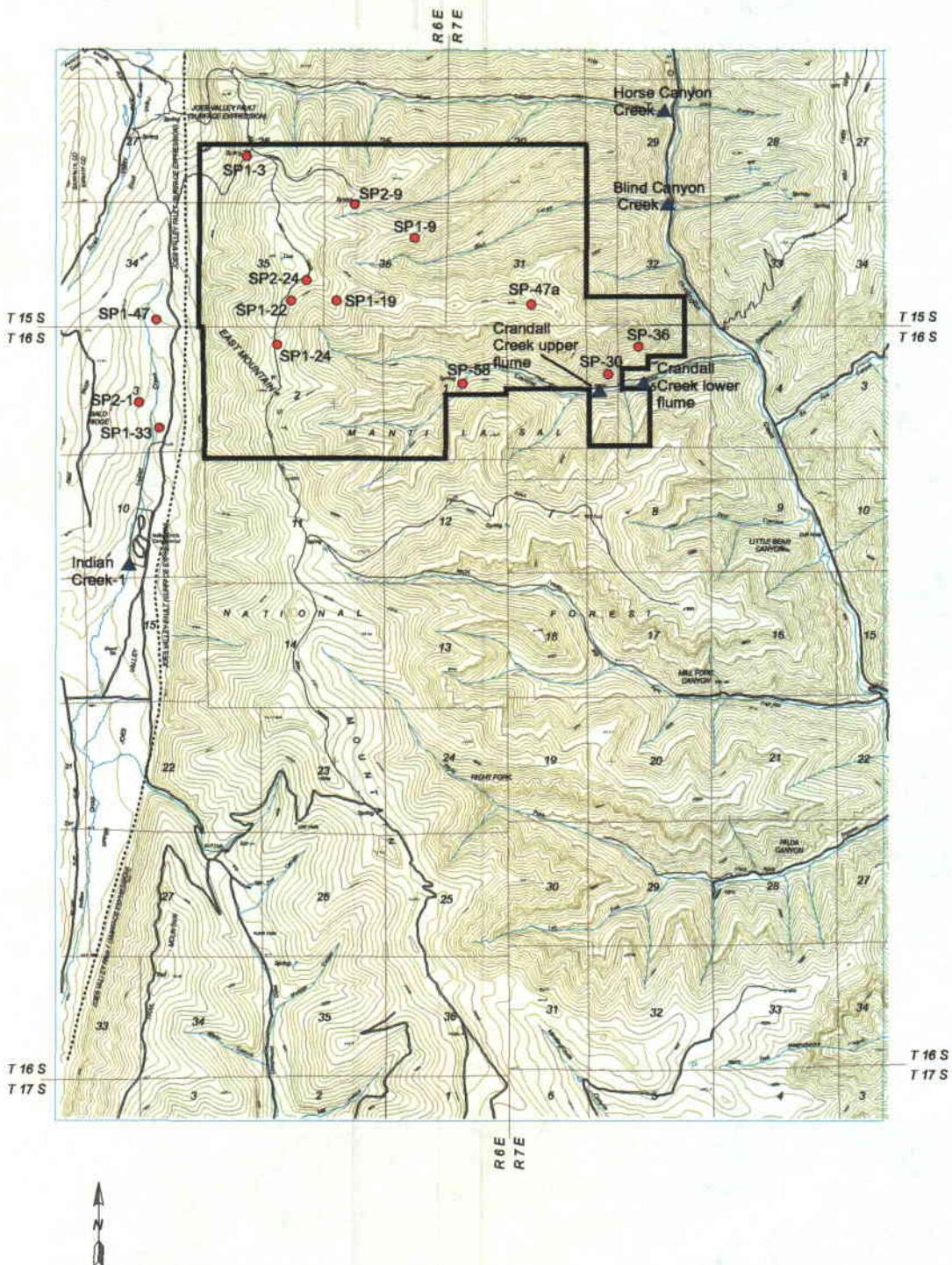


Figure 2 Hydrologic monitoring locations

Upper Flume, Crandall Creek

The Upper Flume on Crandall Creek is located above the GENWAL Mine surface facilities and above the mine discharge point. Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at the Upper Flume of Crandall Creek are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at the Lower Flume are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001 flow measured at the Upper Flume of Crandall Creek ranged from a high of 383 gpm, measured on 1 May, to a low of 234 gpm, measured in March. The stream was not monitored during the peak of the snowmelt period in late May and June. TDS concentrations ranged from a low of 336 mg/l during March, to a high of 383 during May. Total settleable solids were not detected during 2001 and TSS ranged from non-detect to 6 mg/l. During 2001, pH readings at the Upper Flume ranged from 7.8 to 8.4. Concentrations of total and dissolved iron and total manganese were below detection limits during all monitoring events.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at the Lower Flume occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the Upper Flume during 2001.

Lower Flume, Crandall Creek

The Lower Flume on Crandall Creek is located immediately below the GENWAL Mine surface facilities and the mine discharge point. Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at the Lower Flume of Crandall Creek are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at the Lower Flume are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, flow measured during quarterly monitoring activities at the Lower Flume of Crandall Creek ranged from a high of 1,819 gpm, measured in March, to a low of 221 gpm, measured in October. The low discharges measured during September and October occurred because mine discharge, which occurs intermittently, was not occurring at the time of the measurement. TDS concentrations ranged from a low of 398 mg/l during May, to a high of 488 measured during March. TSS concentrations ranged from non-detect to 20 mg/l while total settleable solids were below laboratory detection limits. During 2001, pH readings at the Lower Flume ranged from 7.5 to 8.27. Concentrations of dissolved iron and total manganese were below laboratory detection limits in all sampling events. On a single occasion, total iron was detected at a concentration of 0.2 mg/l. Dissolved oxygen concentrations ranged from 7.1 to 9.2 mg/l. Concentrations of oil and grease were below the laboratory detection limit of 2 mg/l.

The addition of mine discharge water to Crandall Creek results in increases in some chemical parameters relative to those measured at the Upper Flume. The TDS of the mine discharge water during 2001 (about 440 mg/l) is about 60 mg/l higher than that of the receiving water. Most of the increase in the TDS in the Lower Flume water is attributable to modest increases in sulfate, sodium, and bicarbonate. The addition of approximately 1,000 gpm of mine water to the creek (intermittently) results in a significant increase in the baseflow of Crandall Creek below this point (when mine water is being pumped into the creek).

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at the Lower Flume occurred during 2001 relative to historic analytical results.

Other than the water quality impacts noted above, which are related to mine discharge, no impacts to water quality or discharge rate that could be attributable to mining operations were observed at the Lower Flume during 2001.

Horse Canyon Creek

A single location on Horse Canyon Creek is monitored quarterly for field parameters and solute chemistry. Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at Horse Canyon Creek are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at Horse Canyon Creek are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, flow measured at Horse Canyon Creek ranged from a high of 970 gpm, measured in May, to a low of 68 gpm, measured in September. TDS concentrations ranged from a low of 238 mg/l during the May high-flow season, to a high of 527 mg/l in September. Suspended solids were moderate, ranging from 5 to 48 mg/l, while settleable solids were below laboratory detection limits. During 2001, pH readings at Horse Canyon Creek ranged from 8.2 to 8.49. Dissolved oxygen contents range from 8.93 to 9.90 mg/l. Concentrations of dissolved iron and total and dissolved manganese were all below the laboratory detection limits. Total iron ranged from <0.1 mg/l to 0.6 mg/l.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality in Horse Canyon Creek occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at Horse Canyon Creek during 2001.

Blind Canyon Flume

Blind Canyon Creek is monitored quarterly for field parameters and solute chemistry. Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at Blind Canyon Creek are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at Blind Canyon Flume are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, flow measured at Blind Canyon Creek ranged from a high of 488 gpm, measured in May, to a low of 24.8 gpm, measured in September. TDS concentrations ranged from a low of 261 mg/l during the May high-flow season, to a high of 347 mg/l in October. TSS concentrations ranged from non-detect to 34 mg/l during the high-flow season in May. Total settleable solids concentrations were below laboratory detection limits on all monitoring events. During 2001, pH readings at Blind Canyon Creek ranged from 8.3 to 8.6. Dissolved oxygen contents range from 9.0 to 9.49 mg/l. Concentrations of dissolved iron and total manganese were low, with concentrations below the laboratory detection limit. Concentrations of total iron measured during 2001 ranged from non-detect to 0.4 mg/l.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at Blind Canyon Creek occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the Blind Canyon Flume during 2001.

Indian Creek

Indian Creek drains a small portion of the permit area immediately west of the Joes Valley Fault system. Indian Creek is monitored quarterly for field parameters and solute chemistry. Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at Indian Creek are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at Indian Creek are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, flow measured at Indian Creek ranged from a high of 1,184 gpm, measured in June, to a low of 580 gpm, measured in October. TDS concentrations were relatively constant, ranging from 255 to 267 mg/l. Total suspended solids concentrations ranged from on-detect to 12 mg/l. During 2001, pH readings at Indian Creek ranged from 7.81 to 8.35. Dissolved oxygen contents range from 87.3 to 9.43 mg/l. Concentrations of dissolved iron and total manganese were below the laboratory detection limit. The concentrations of total iron measured during the high-flow season in June was 0.1 mg/l.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at Indian Creek occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at Indian Creek during 2001.

SP-30

During 2001, SP-30, which is located just above the Crandall Canyon mine portals, discharges small quantities of water. The water from SP-30 emanates below a large Blackhawk Formation channel sandstone as diffuse discharge from the south-facing hillside. The discharge, measured at the area of greatest seepage, ranged from 0.031 to 0.121 gpm. The combined discharge from the seepage area was estimated to be about four times the discharge measured during monitoring activities, or about 0.13 to 0.5 gpm. The pH measured at this spring ranged from 7.7 to 8.09, while the conductivity ranged from 744 to 822 us/cm. The temperature measured at SP-30 ranged from 2.5 to 14.1 °C. The wide range of temperatures is likely the result of the low flow rate from the spring (i.e., the spring water is highly influenced by the temperature of the soil and air at the time of sampling).

SP-36

Spring SP-36 discharges from the south-facing hillside above and east of the Crandall Canyon Mine portals. Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP-36 are shown on the previous page. Discharge from SP-36 ranged from 0.744 to 0.950 gpm. TDS concentrations ranged from 355 to 408 mg/l. The pH at Sp-36 ranged from 7.8 to 8.07, and temperature ranged from 5.4 to 11.7. Concentrations of total and dissolved iron and manganese were below laboratory detection limits.

SP-58

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP-58 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP-58 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, flow measured at SP-58 ranged from a high of 23.75 gpm, measured in May, to a low of 16.5 gpm, measured in October. The spring was not monitored during the peak of the high-flow season in June. It is likely that the spring discharged a somewhat greater flow rates during that period. TDS concentrations ranged from a low of 377 mg/l during May, to a high of 409 mg/l in September. During 2001, pH readings at SP-58 ranged between 7.56 and 7.77. Concentrations of total and dissolved iron and total manganese were below laboratory detection limits.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at SP-58 occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at SP-58 during 2001.

SP2-24

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP2-24 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP2-24 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, flow measured at SP2-24 ranged from a high of 2.05 gpm, measured during June, to 0.233 gpm during September. TDS concentrations ranged from 190 to 304 mg/l. During both monitoring events in 2001, the pH was approximately 8.1. The concentrations of dissolved iron and total and dissolved manganese were below the laboratory detection limit. During the September monitoring event, the total iron concentration was 0.5 mg/l. The elevated total iron concentration is likely the result of sediment in the sample bottle and is not representative of conditions at the spring.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at SP2-24 occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at SP2-24 during 2001.

SP2-9

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP2-9 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP2-9 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP2-9 was measured at 5.83 gpm during June, and 0.257 gpm during October. The TDS concentration ranged from 147 to 205 mg/l. The pH ranged from 7.42 to 7.77. Concentration of dissolved iron and total and dissolved manganese were below the laboratory detection limit, while the concentrations of total iron was 0.1 mg/l during June.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at SP2-9 occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP2-9 during 2001.

SP-47a

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP-47a are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP-47a are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During monitoring activities at SP-47a in 2000, no groundwater discharge in the vicinity of the mapped location of the spring was found. During June 2001, the spring was located and found to be discharging at 1.47 gpm. By early September, discharge at the spring had declined to 0.276 gpm. The pH during 2001 ranged from 7.05 to 8.3 and the electrical conductivity ranged from 351 to 437 $\mu\text{S}/\text{cm}$.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP-47a during 2001.

SP1-3

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-3 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-3 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP1-3 ranged from a high of 0.513 gpm during June, to 0.114 gpm during October. The pH ranged from 7.31 to 7.82. The electrical conductivity ranged from 197 to 282 $\mu\text{s}/\text{cm}$.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-3 during 2001.

SP1-19

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-19 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-19 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP1-19 ranged from a high of 29.4 gpm during June, to a low of 1.3 gpm during October. The pH ranged from 7.96 to 8.25. The electrical conductivity ranged from 390 to 453 $\mu\text{s}/\text{cm}$.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-19 during 2001.

SP1-22

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-22 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-22 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP1-22 ranged from a high of 3.26 gpm during June, to a low of 0.268 gpm during October. The pH ranged from 7.24 to 8.21. Electrical conductivity ranged from 265 to 326 $\mu\text{s}/\text{cm}$.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-22 during 2001.

SP1-33

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-33 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-33 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP1-33 ranged from a high of 3.19 gpm during June, to 2.31 gpm during October. The TDS concentration ranged from a low of 269 mg/l in June to a high of 324 mg/l during September. During 2001, the pH ranged from 6.88 to 7.58. Concentrations of dissolved iron and total and dissolved manganese were less than the laboratory detection limit of 0.1 mg/l. The total iron concentration measured during June was 0.1 mg/l and in October it was 0.2 mg/l. It is difficult to obtain a sediment-free sample from the spring because of the loose, thick, organic soils that are present in the spring discharge area that are difficult not to disturb. The total iron concentration is a result of sampling difficulties and is not related to conditions in the groundwater system from which the spring discharges. This is evidenced by the lack of any detectable iron in the dissolved form from the spring.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at SP1-33 occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-33 during 2001.

SP1-47

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-47 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-47 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP1-47 ranged from a high of 9.02 gpm during October, to 4.04 gpm during June. The pH ranged from 8.21 to 8.38. Electrical conductivity ranged from 378 to 443 $\mu\text{s}/\text{cm}$.

Examination of results of field parameter measurements (Table 2) in the context of historic data suggests that no significant changes in water quality at SP1-47 occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-47 during 2001.

SP2-1

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP2-1 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP2-1 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP2-1 ranged from a high of 19.4 gpm during June, to a low of 1.266 gpm during October. The pH ranged from 7.46 to 8.29. Electrical conductivity ranged from 479 in June to 516 $\mu\text{S}/\text{cm}$ in October.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP2-1 during 2001.

SP1-9

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-9 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-9 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge at SP1-9 ranged from a high of 3.06 gpm during June, to a low of 0.566 gpm during October. The TDS concentration measured during June was 163 while the TDS measured in September was 222 mg/l. The pH ranged from 7.47 to 8.29. Concentrations of dissolved iron and total and dissolved manganese were below the laboratory detection limit. Total iron concentrations were above the laboratory detection limit in each sampling event. This is due to difficulties in obtaining a sediment free sample from the spring location. The spring discharges at the contact of a permeable horizon near a ridge top with an underlying clayey deposit that likely contains iron.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality at SP1-9 occurred during 2001.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-9 during 2001.

SP1-24

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at SP1-24 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at SP1-24 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, discharge from spring SP1-24 ranged from 0.798 gpm in June to 0.119 gpm during October. The pH ranged from 7.17 to 8.08 and the electrical conductivity ranged from 395 to 401 $\mu\text{S}/\text{cm}$.

No impacts to water quality or discharge rate that could be attributable to mining operations were observed at the SP1-24 during 2001.

DH-1

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well DH-1 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at DH-1 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

DH-1 was dry during each of the four quarterly monitoring events during 2001.

DH-2

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well DH-2 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at DH-2 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

DH-2 was inaccessible during each of the four quarterly monitoring events during 2001.

MW-1

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well MW-1 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-1 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, no discharge occurred during the March, May, or September monitoring events. During the December monitoring event, the well briefly discharged at a rate of 0.3 gpm. The TDS measured in December was 274 mg/l. The pH was 8.0. Dissolved iron and total and dissolved manganese were not detected in the December sample. A total iron concentration of 0.7 mg/l was measured. The presence of total iron in the sample is likely the result of contact with the steel well casing and piping. MW-1 is only rarely pumped and the water that briefly discharges from the well likely resided in the well casing for an appreciable time.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality in MW-1 occurred during 2001. Rather, the water quality remained relatively constant.

No impacts to water quality that could be attributable to mining operations were observed at the MW-1 during 2001. The decline in the discharge rate from MW-1 that occurred in 1989 is likely due to the limited extent of the Star Point Sandstone groundwater system in which the well is completed. The Star Point Sandstone groundwater system is likely not in good hydraulic communication with recharge sources.

MW-2

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well MW-2 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-2 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

Throughout 2001, that portion of the mine in which MW-2 is located has been flooded with mine operational water. As a result, the water in the well bore is not representative of conditions in the Star Point Sandstone groundwater system in which the well is completed. As a result, operational hydrologic monitoring of MW-2 was not carried out.

MW-3

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well MW-3 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-3 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

Throughout 2001, the well has been inaccessible.

MW-4

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well MW-4 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-4 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

Throughout 2001, MW-4 has been inaccessible.

MW-5

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well MW-5 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-5 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

Well MW-5 was previously destroyed as a result of mining operations. No monitoring of this well is possible.

MW-6

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at in-mine well MW-6 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-6 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, the well was impacted by mining operations and was not available for monitoring. During mining in the vicinity of the well, the casing was sheared at the surface and coal debris covers the well location. It is doubtful that the well could be made available for monitoring in the future.

No monitoring of well MW-6 occurred during 2001.

MW-6a

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at MW-6a are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-6a are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, the well was impacted by mining operations and was not available for monitoring. During mining in the vicinity of the well, the casing was sheared at the surface and coal debris covers the well location. It is doubtful that the well could be made available for monitoring in the future.

No monitoring of well MW-6a occurred during 2001.

MW-7

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at MW-7 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-7 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, TDS concentrations at MW-7 ranged from 275 mg/l to 323 mg/l, while the pH ranged from 7.5 to 7.8. Concentrations of dissolved iron and total and dissolved manganese were below laboratory detection limits. The concentration of total iron ranged from 0.1 to 0.3 mg/l.

The discharge from MW-7 remained constant during 2001 at approximately 0.1 gpm.

Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality in MW-7 occurred during 2001.

MW-8

Time series plots of discharge, TDS, pH, Fe(T), Fe(d), and Mn(T) at MW-8 are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements at MW-8 are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, mining operations were conducted in the vicinity of MW-8 and, consequently, the well was not available for monitoring. It is doubtful that the well could be made available for monitoring in the future.

Sediment Pond (UPDES 001)

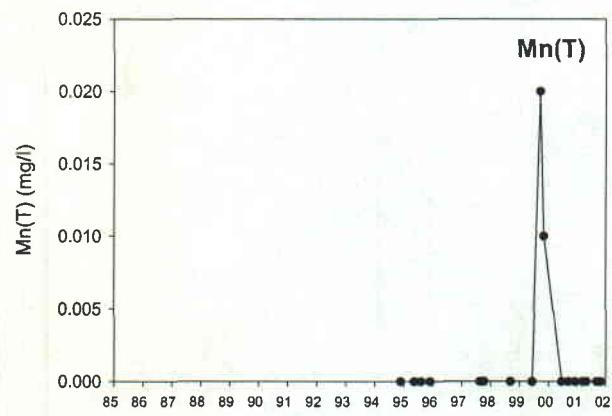
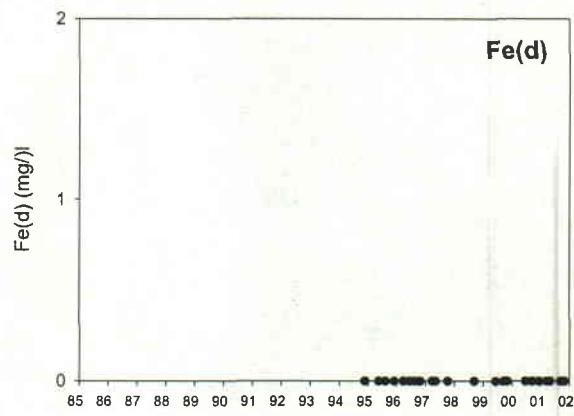
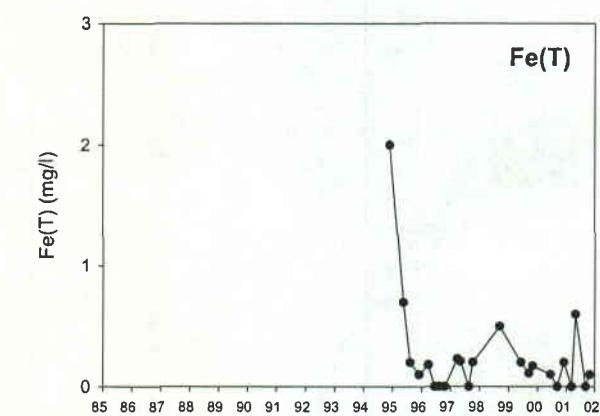
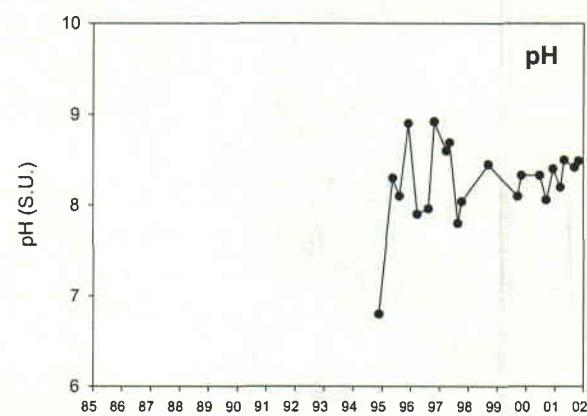
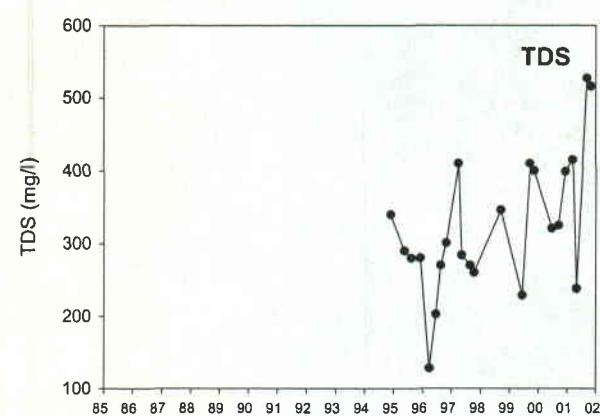
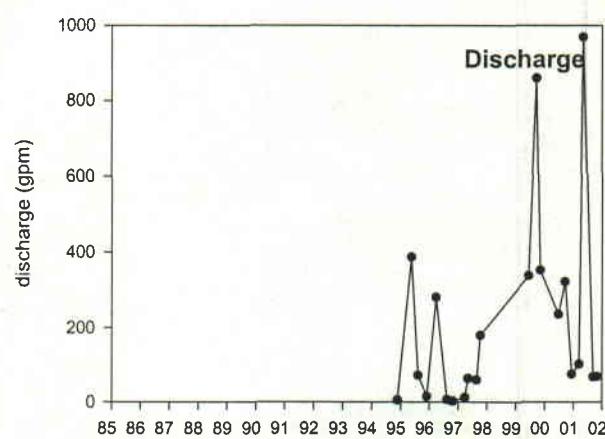
There were no discharges from the sediment pond during 2001.

Mine discharge water (UPDES 002)

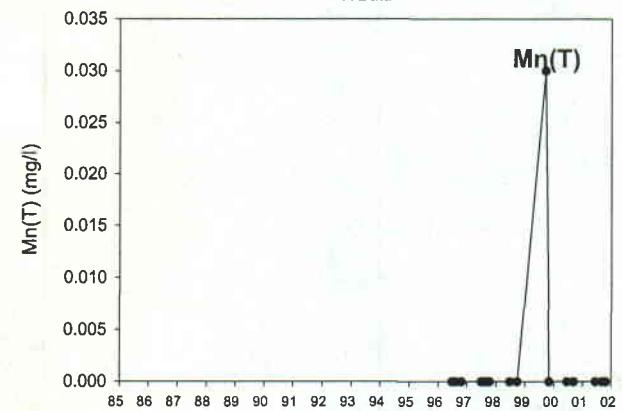
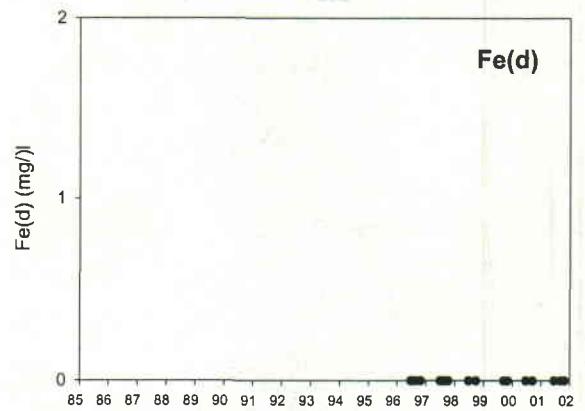
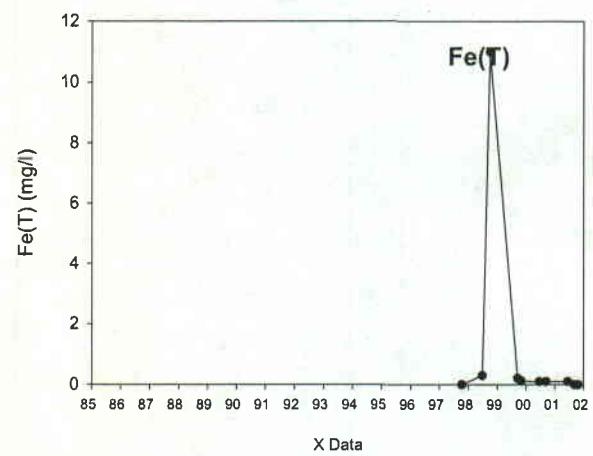
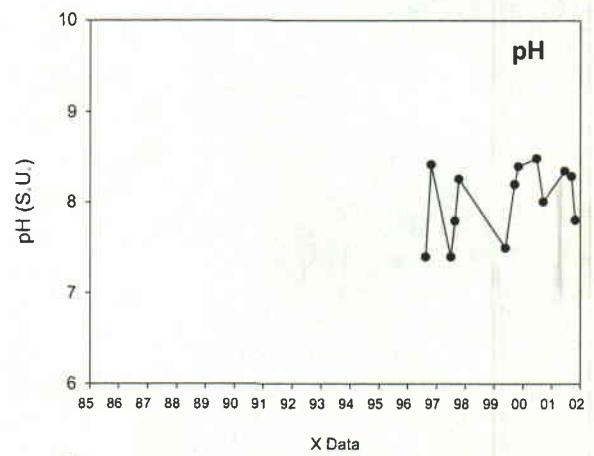
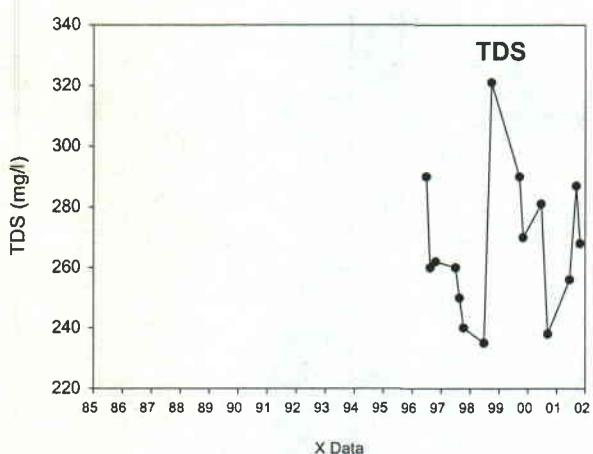
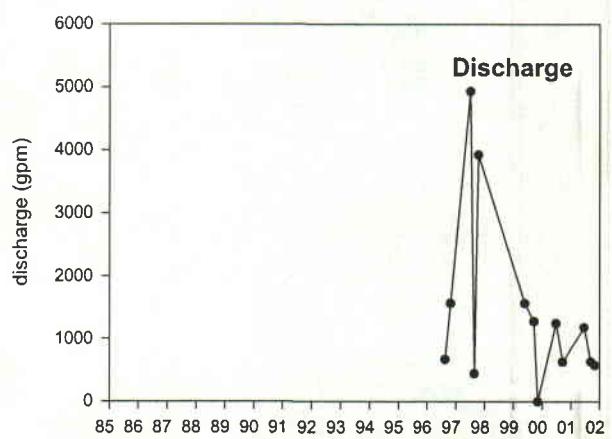
Time series plots of discharge, TDS, pH, Fe(T), Fe(d), Mn(T), TSS, and oil and grease in mine discharge water are shown on the previous page. The results of the 2001 hydrologic monitoring, including field measurements and complete water quality laboratory measurements of mine discharge water are shown on Table 1. Historic water chemistry and field parameter measurements are shown in Table 2.

During 2001, monthly mean discharge from the mine ranged from 780 to 1050 gpm. TDS concentrations ranged from 402 to 499 mg/l. During 2001, pH ranged from 6.9 to 7.8. Concentrations of dissolved iron were all less than the laboratory detection limit, while total iron was detected above laboratory detection levels only during November (0.1 mg/l).

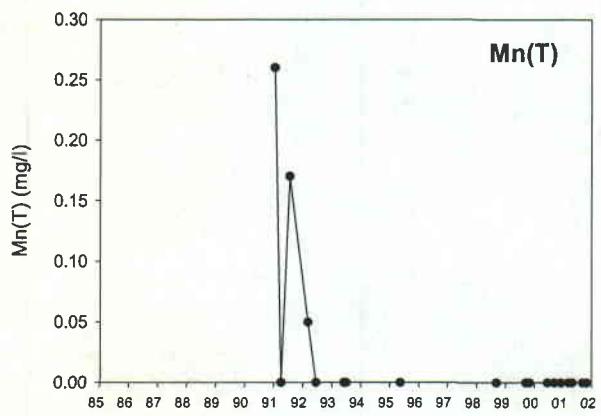
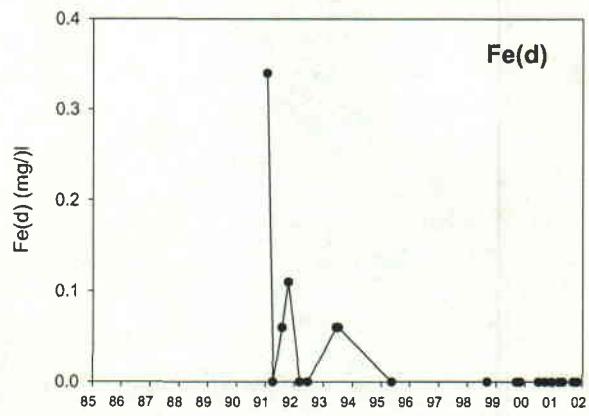
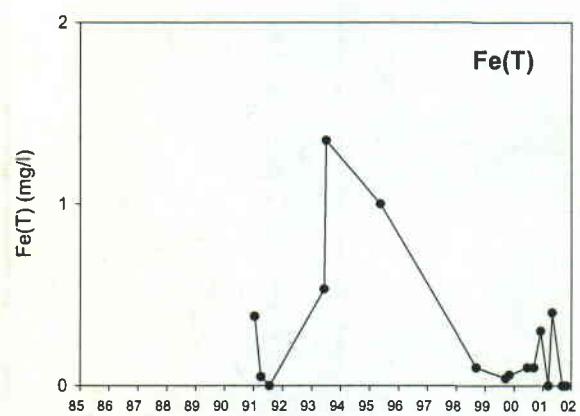
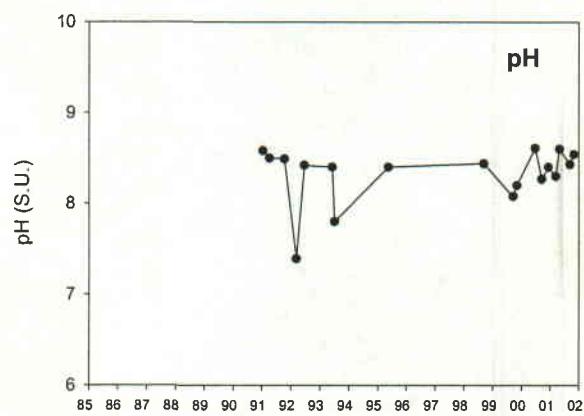
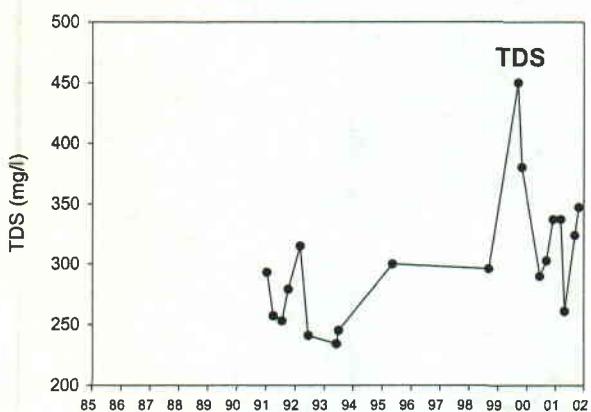
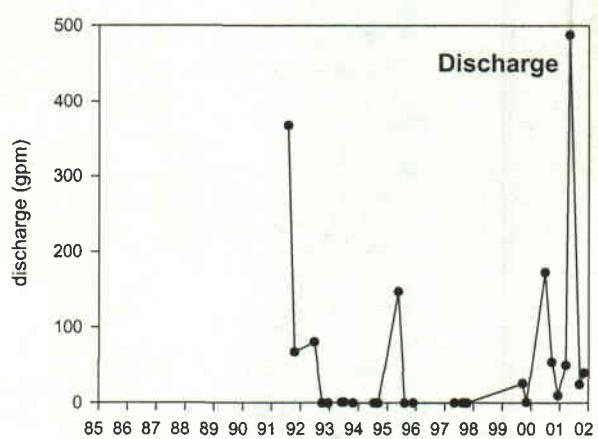
Examination of analytical results for important chemical parameters (Table 2) in the context of historic data suggests that no significant changes in water quality of mine discharge water occurred during 2001.



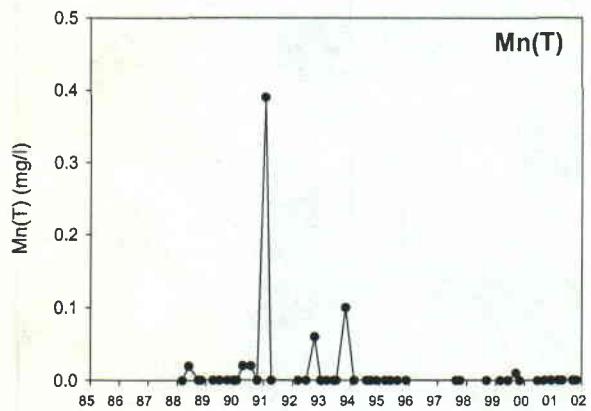
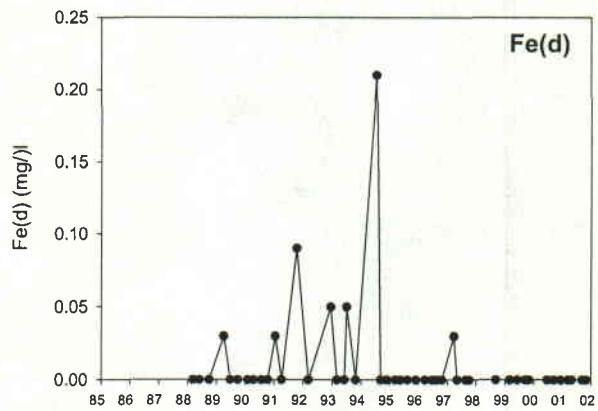
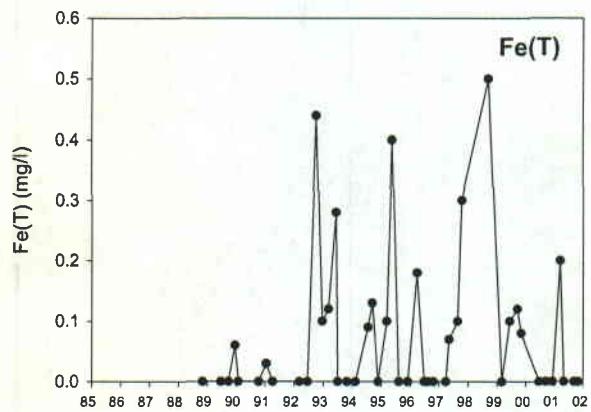
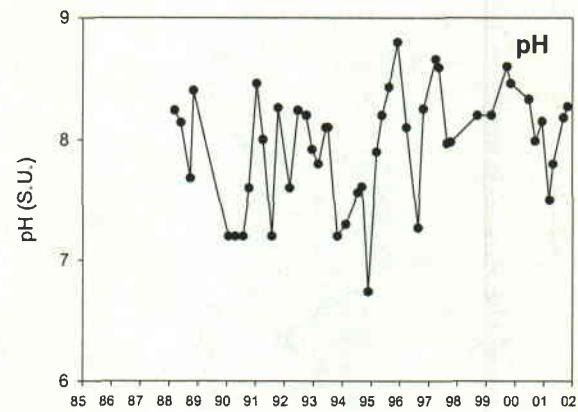
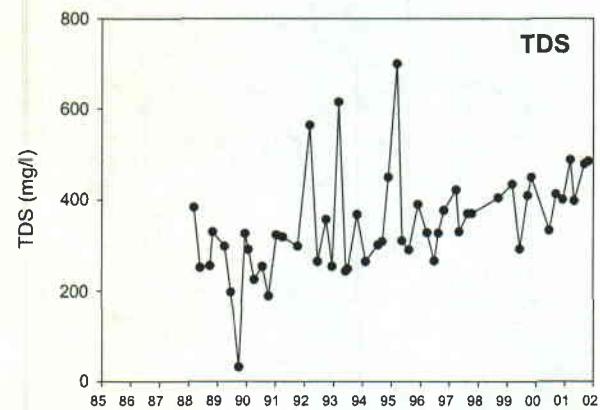
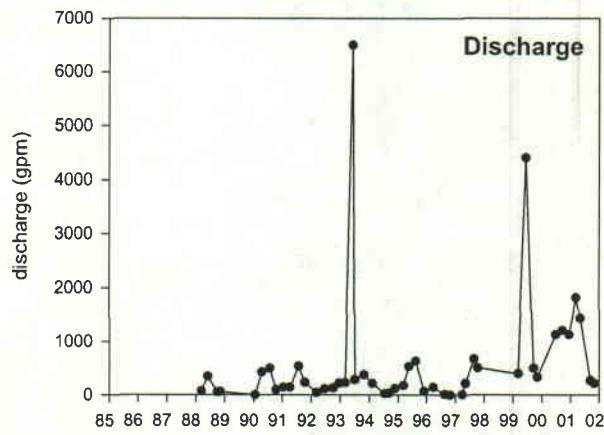
Horse Canyon Creek



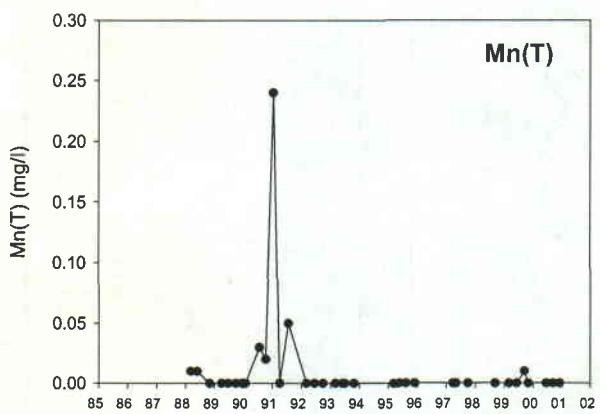
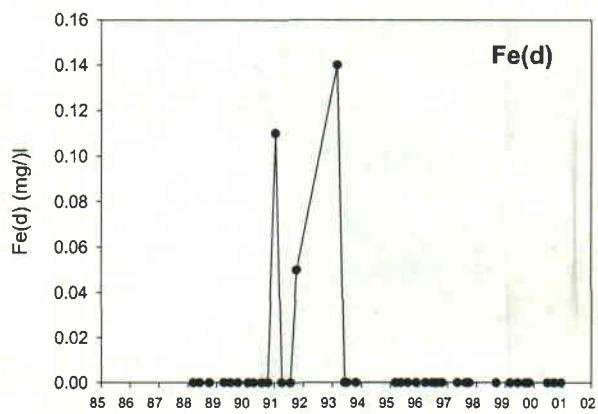
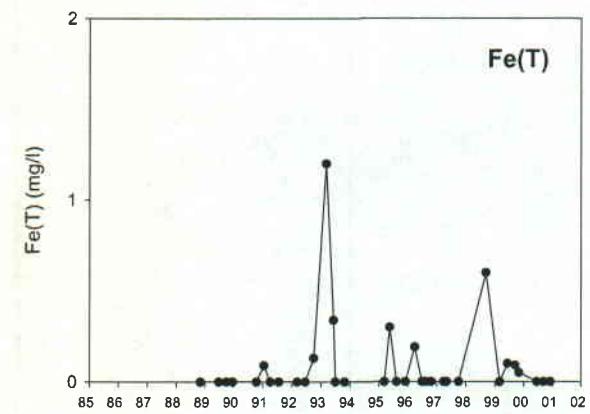
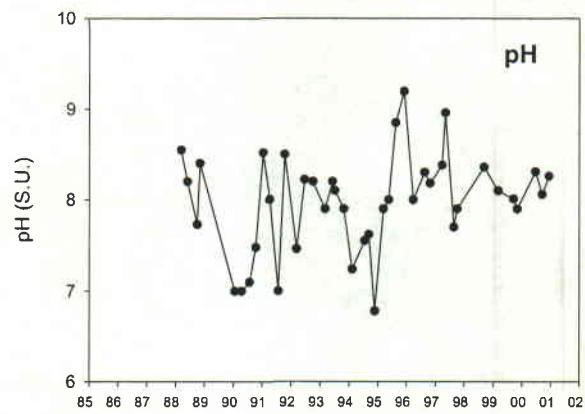
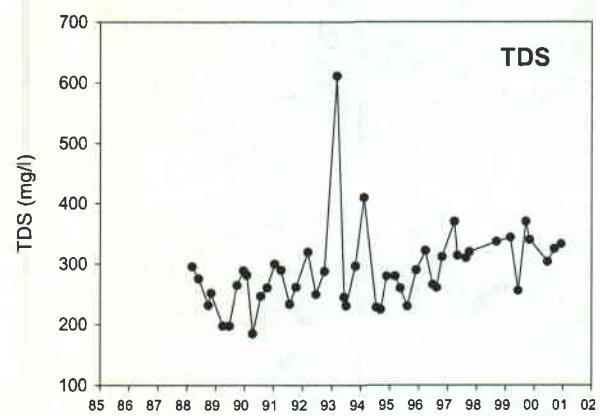
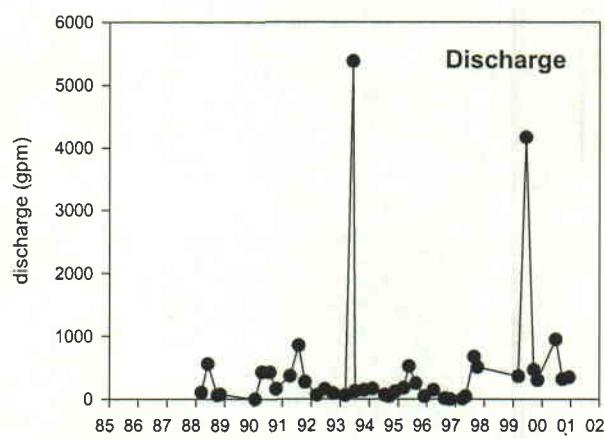
Indian Creek



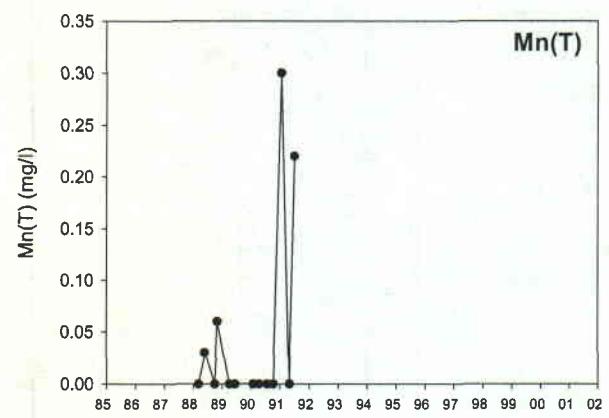
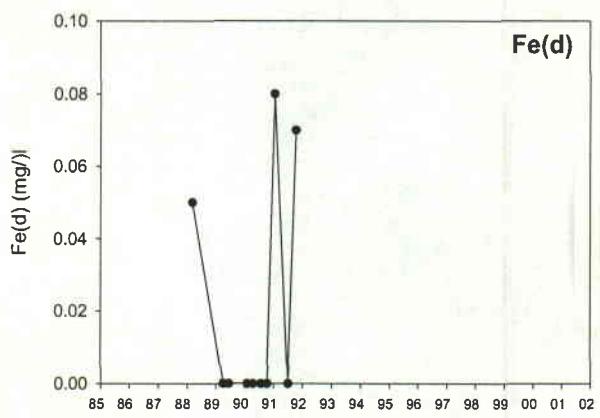
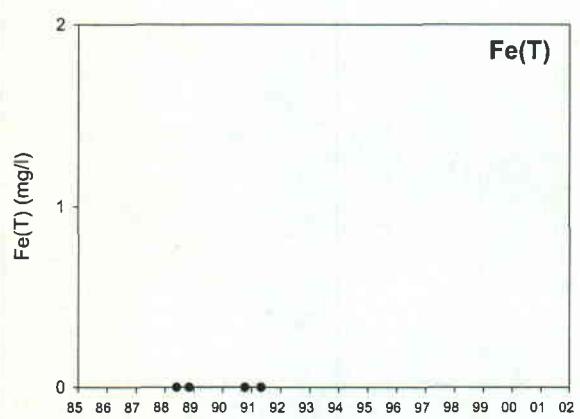
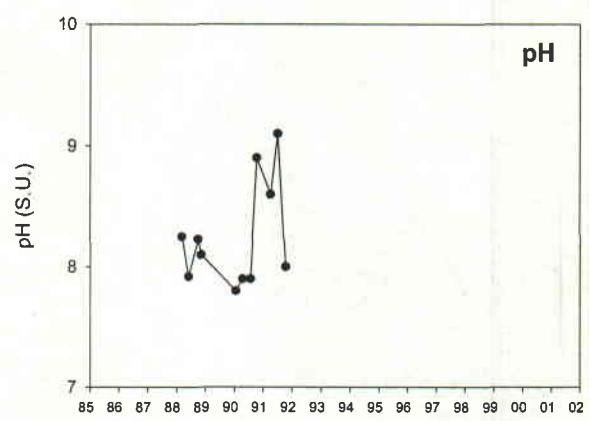
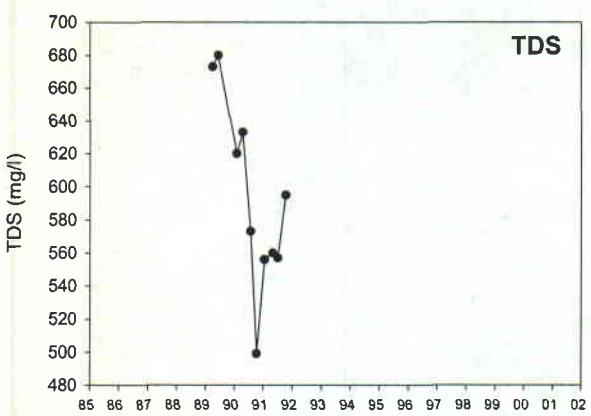
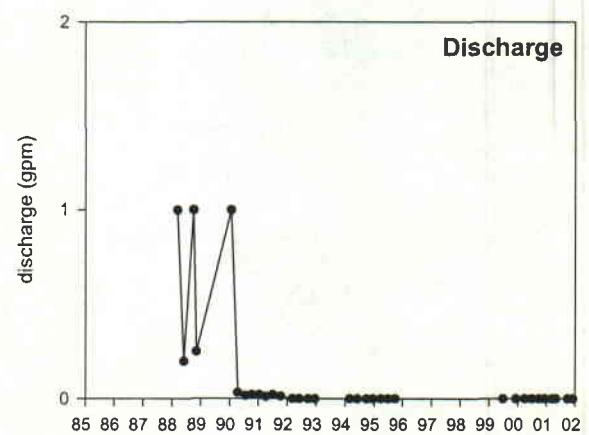
Blind Canyon Flume



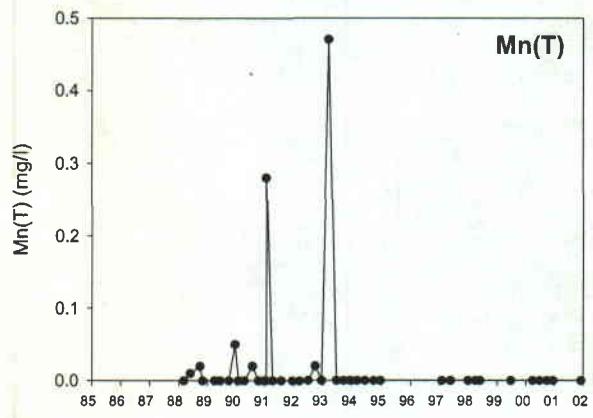
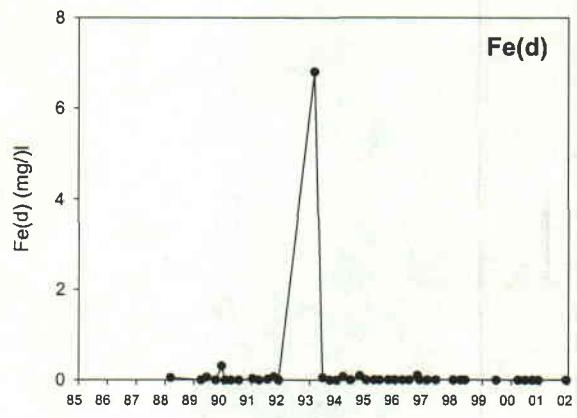
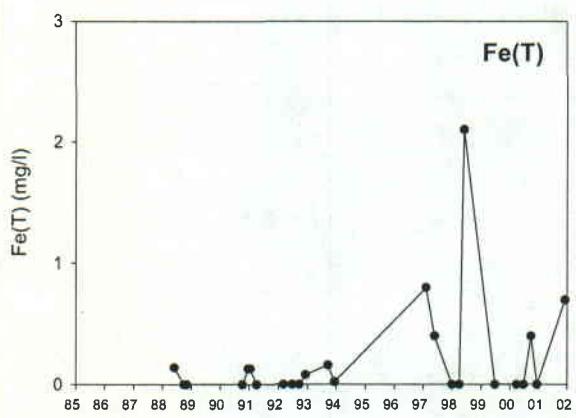
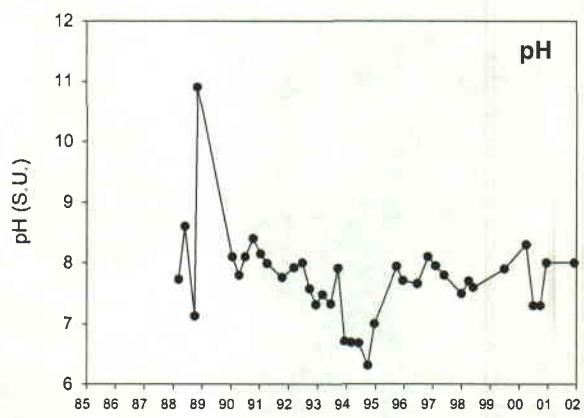
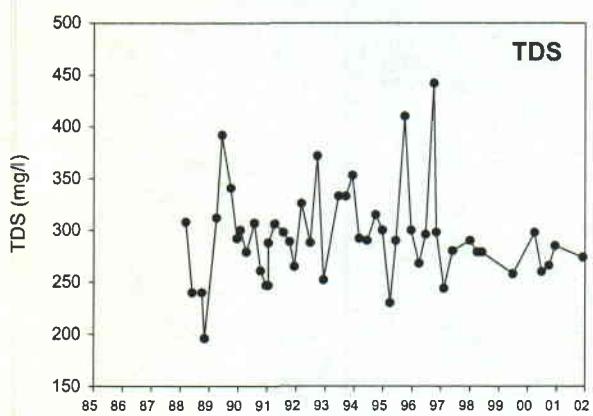
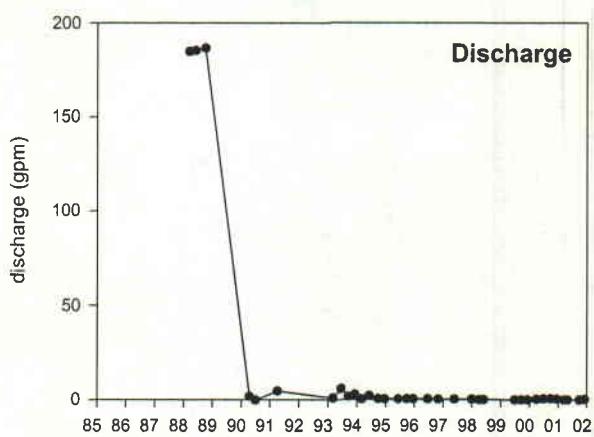
Lower Flume Crandall Creek



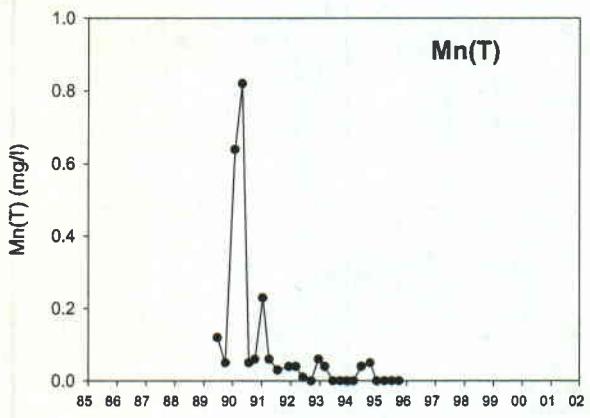
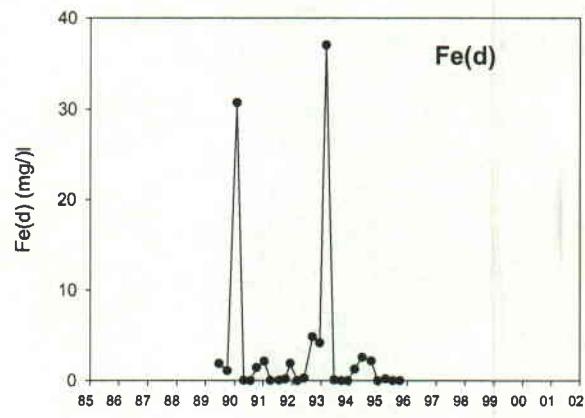
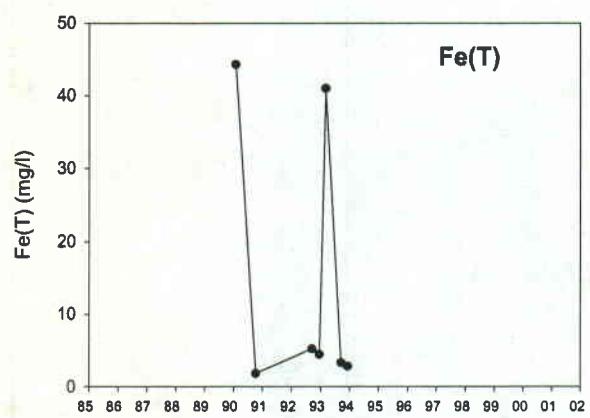
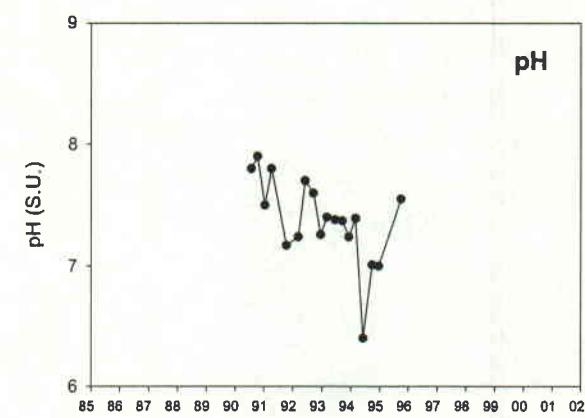
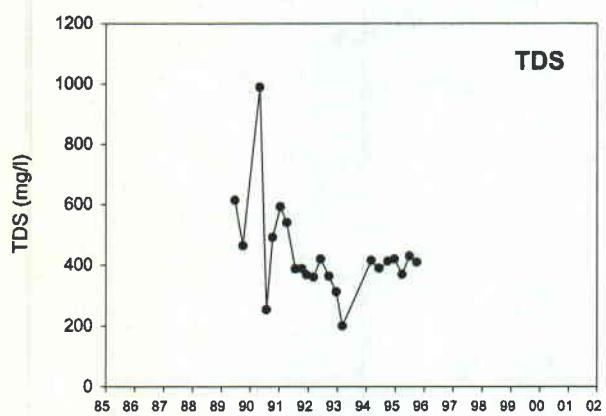
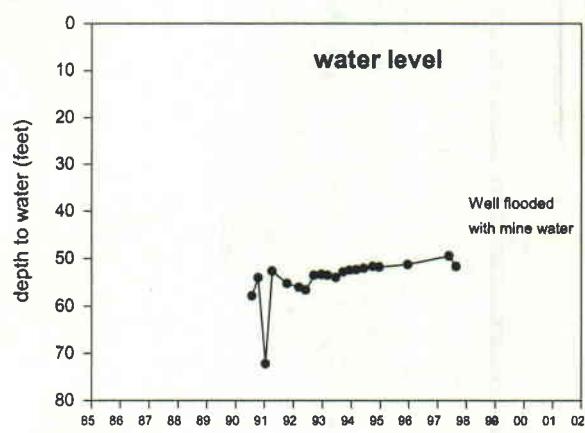
Upper Flume Crandall Creek



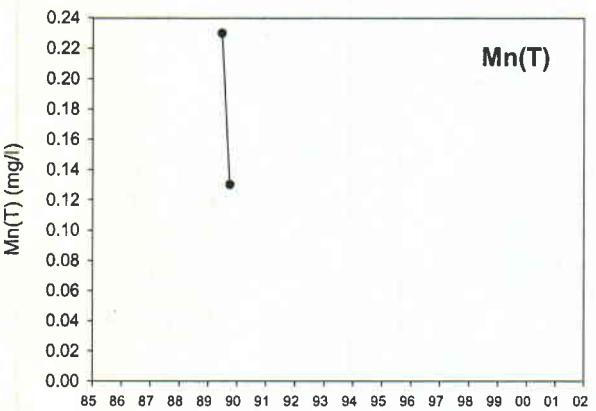
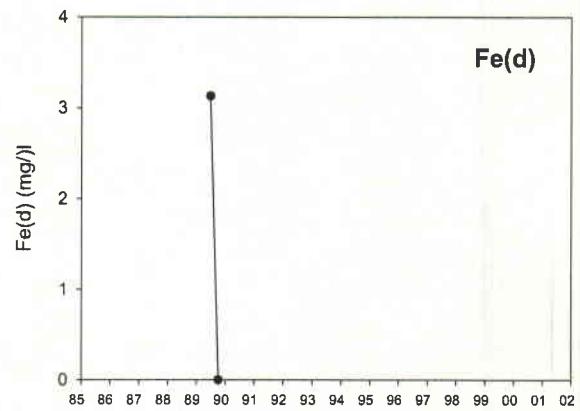
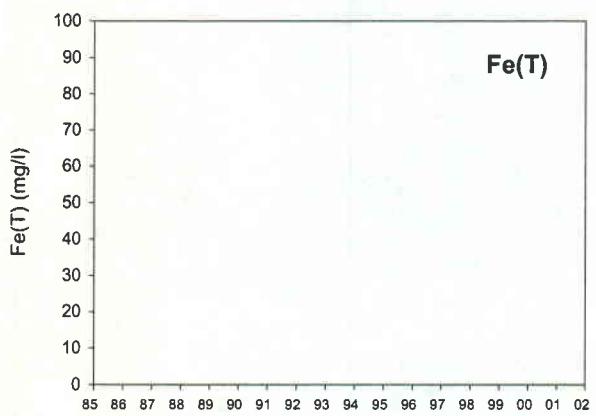
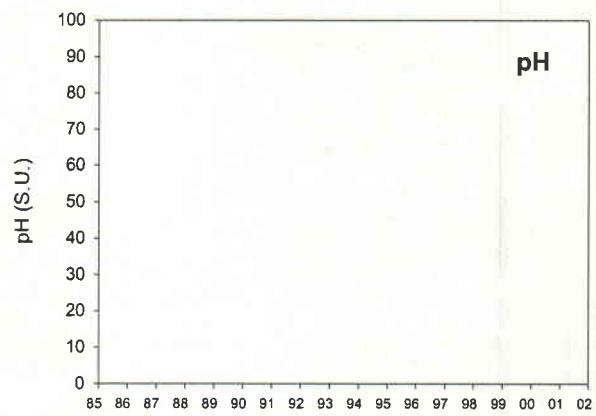
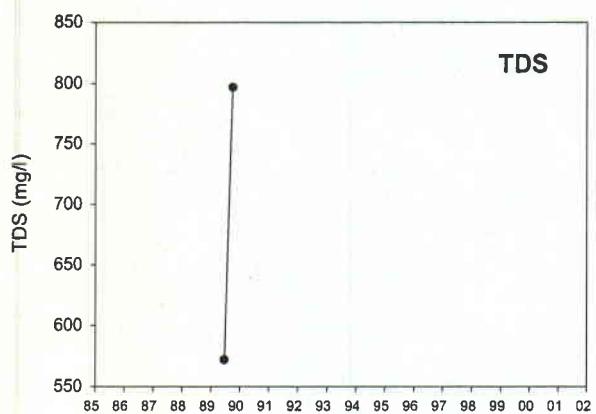
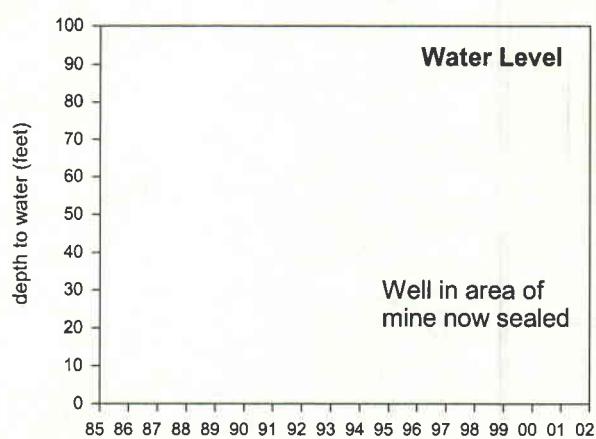
DH-1



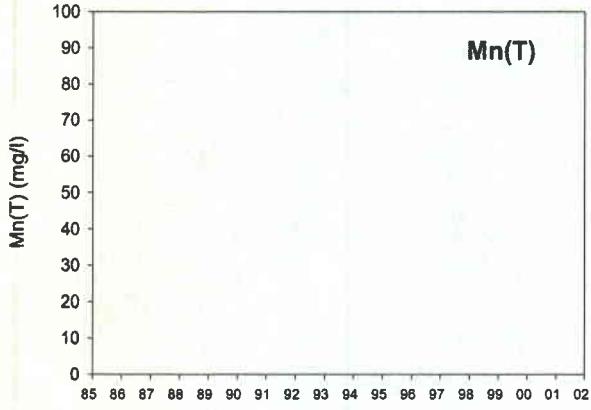
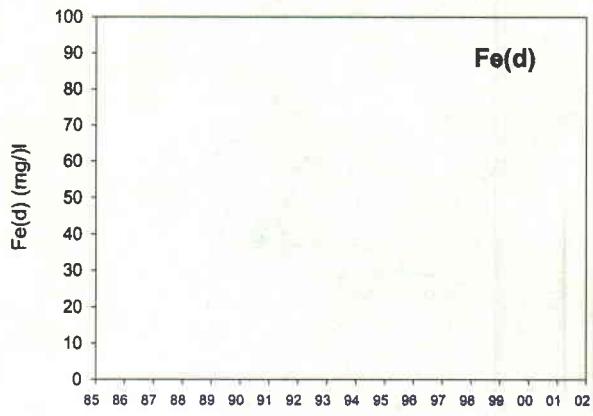
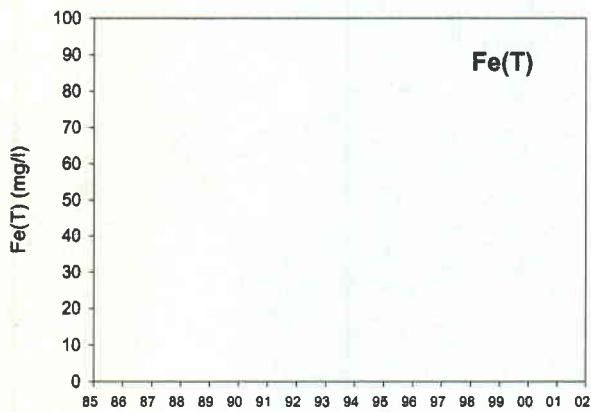
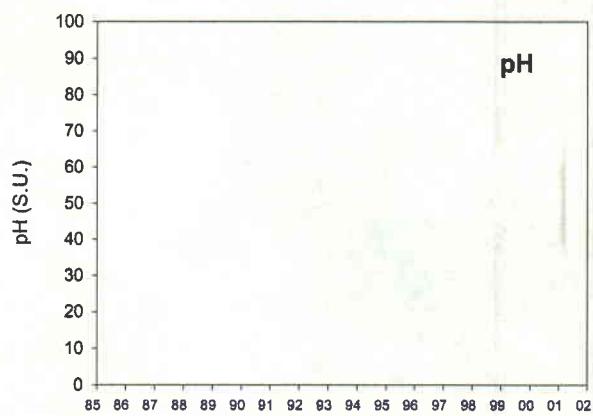
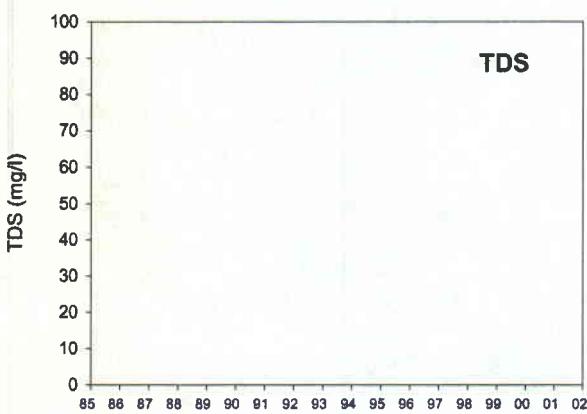
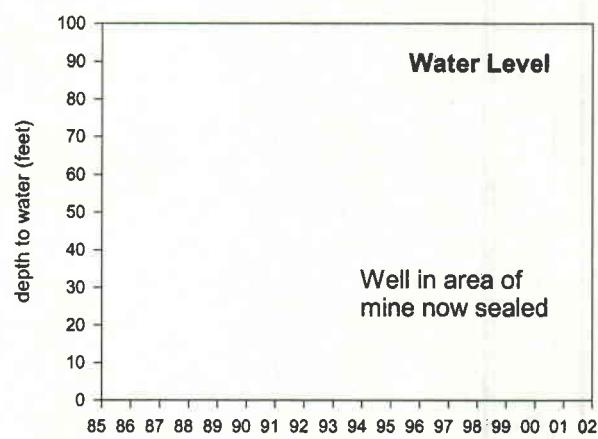
MW-1



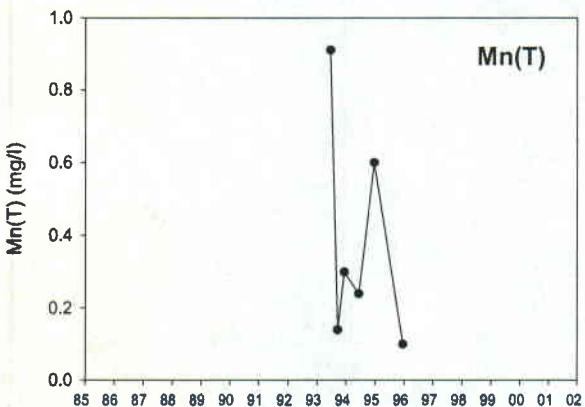
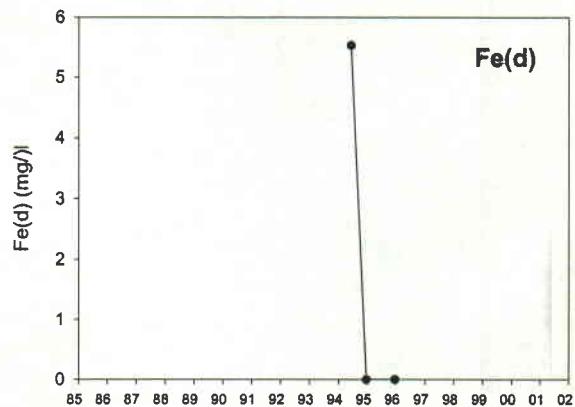
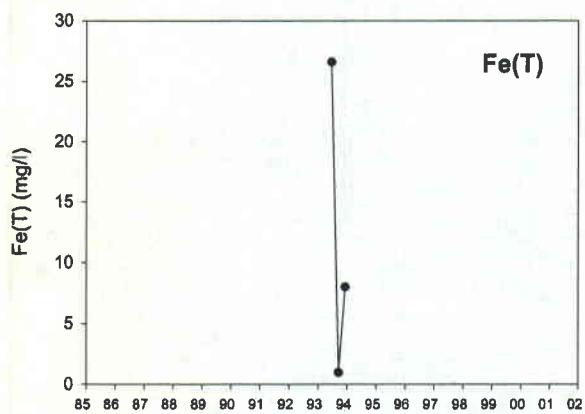
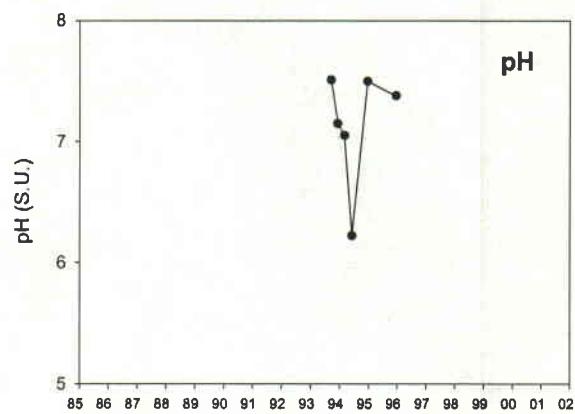
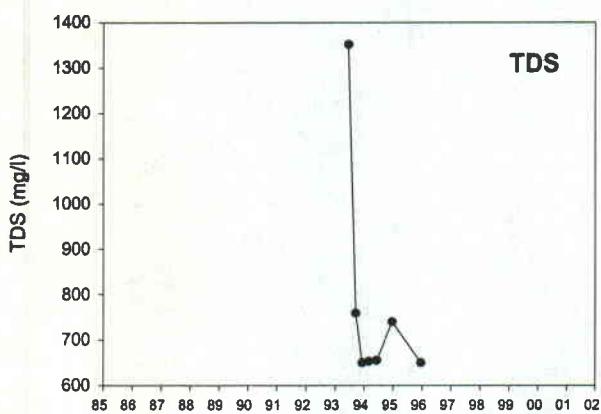
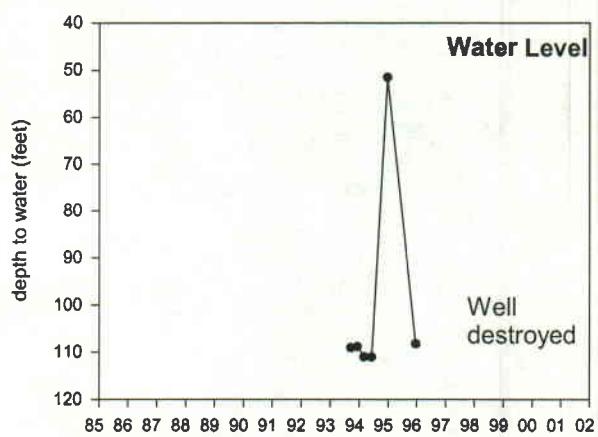
MW-2



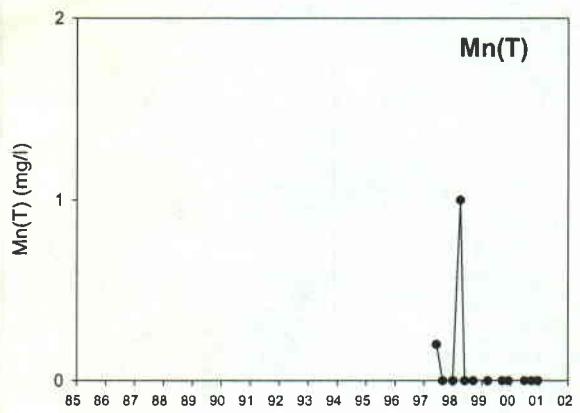
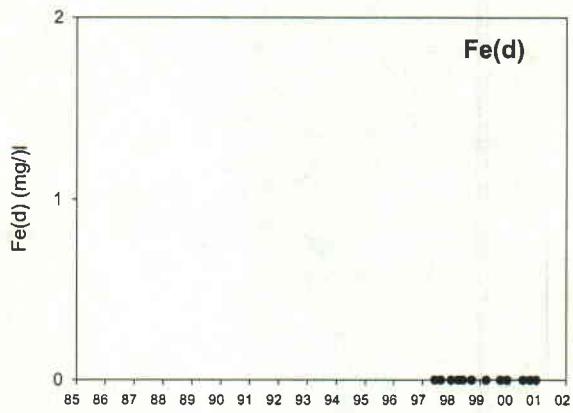
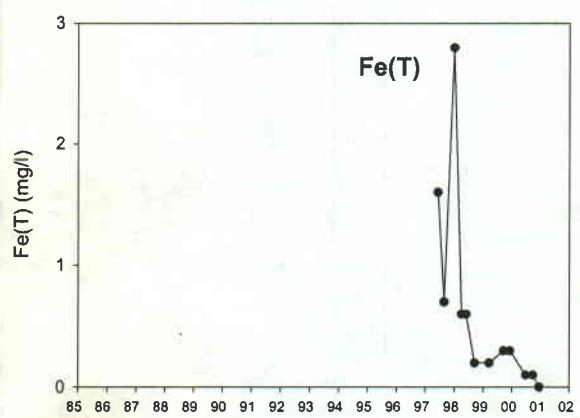
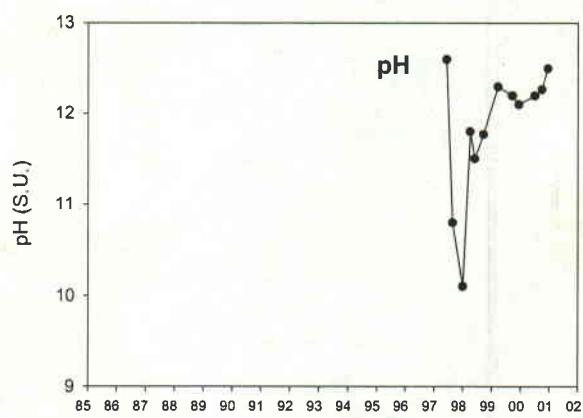
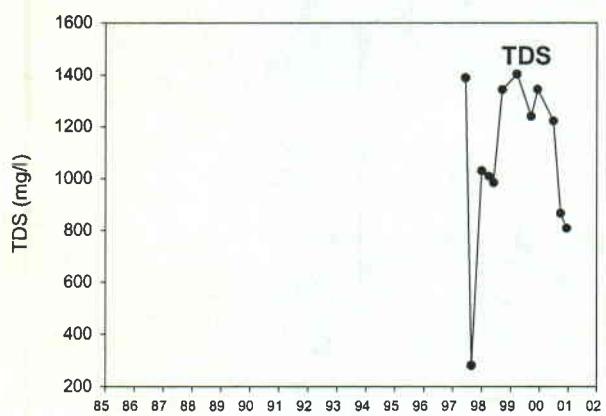
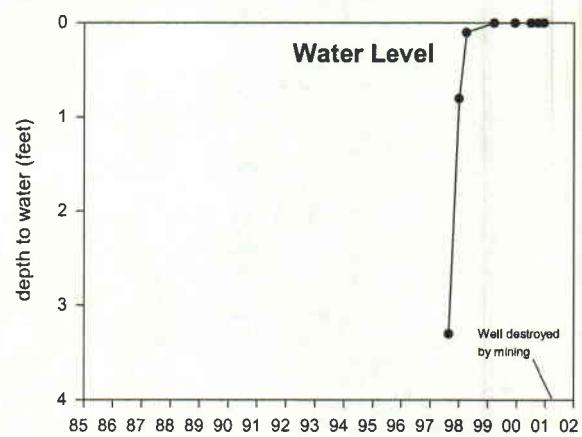
MW-3



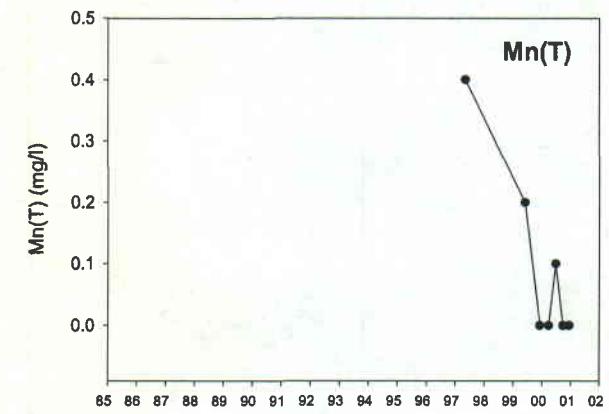
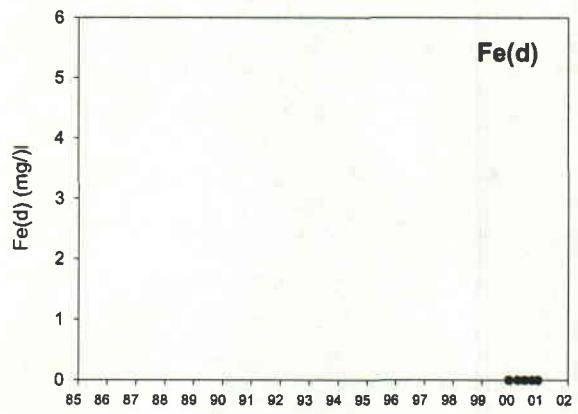
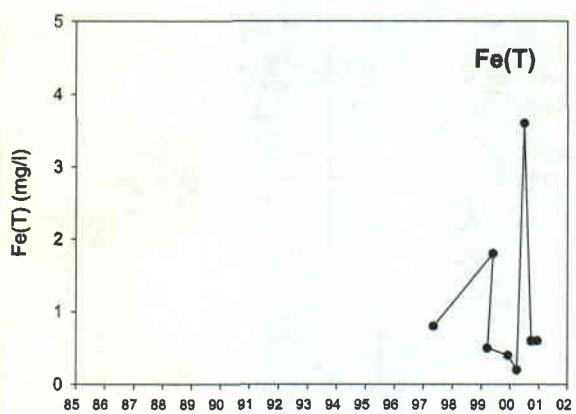
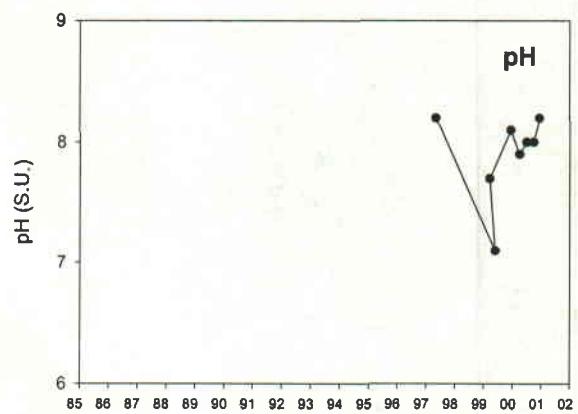
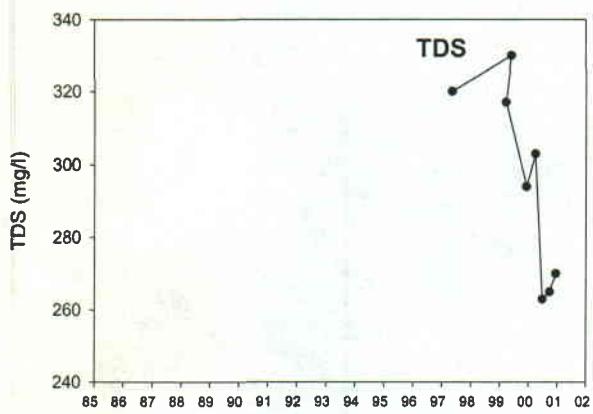
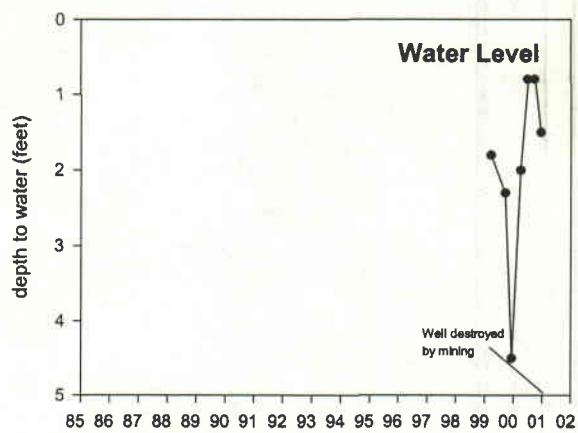
MW-4



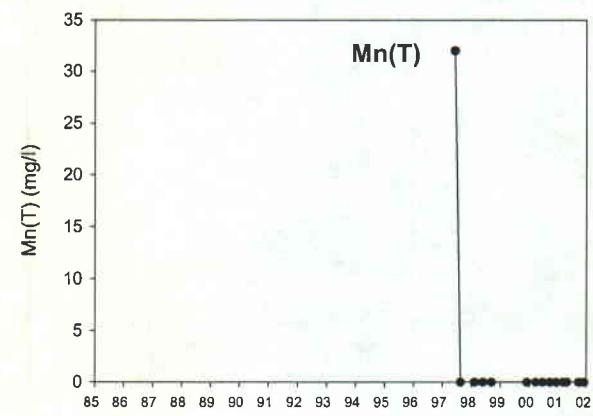
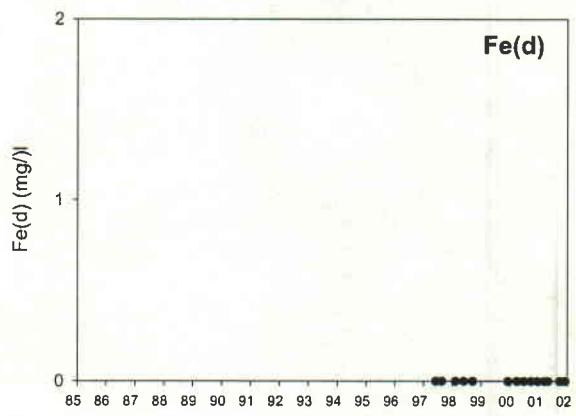
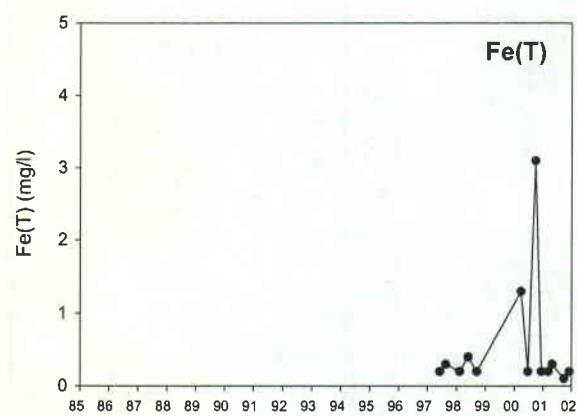
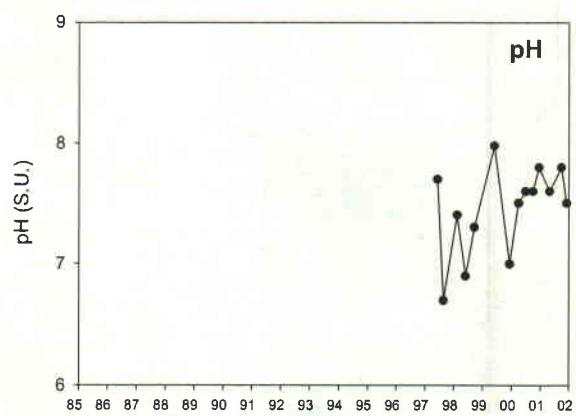
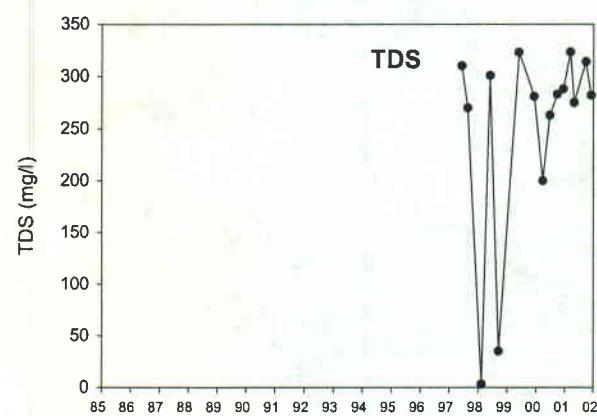
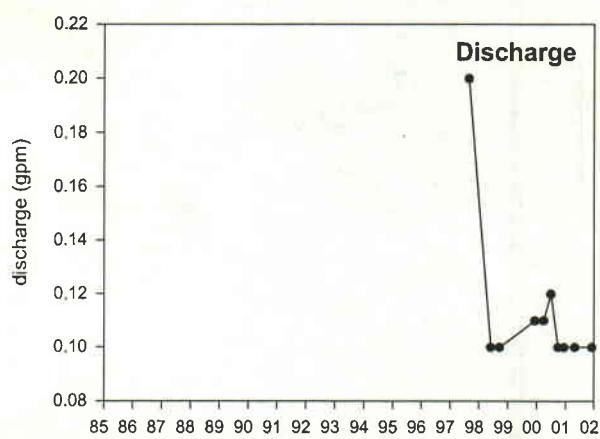
MW-5



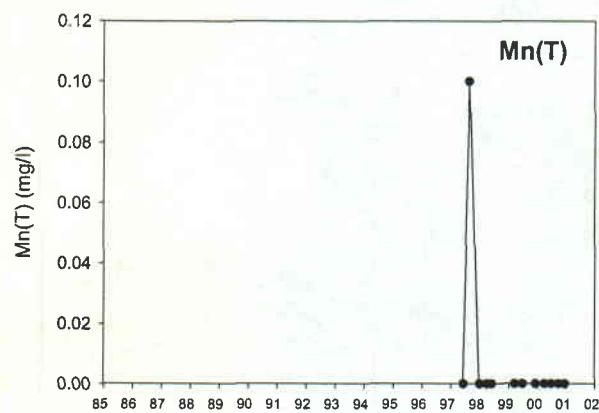
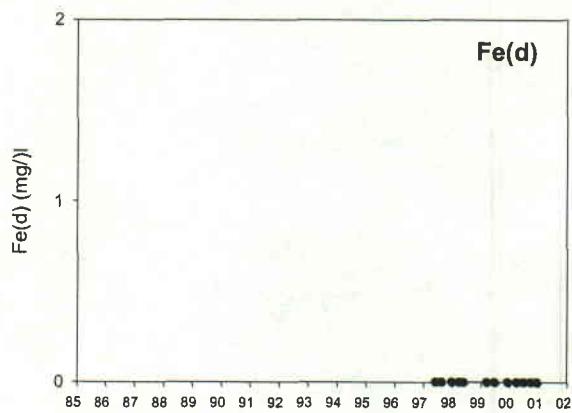
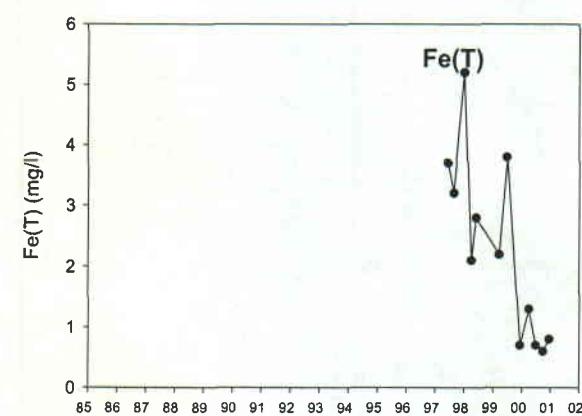
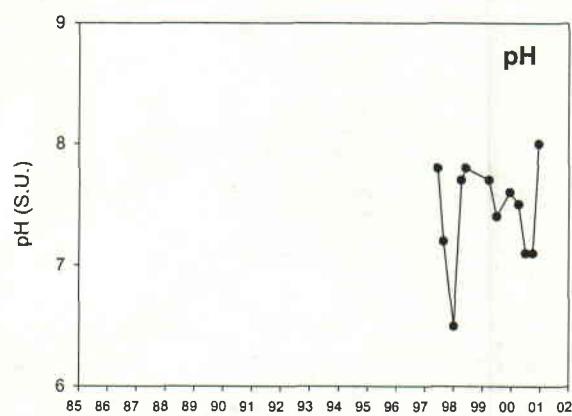
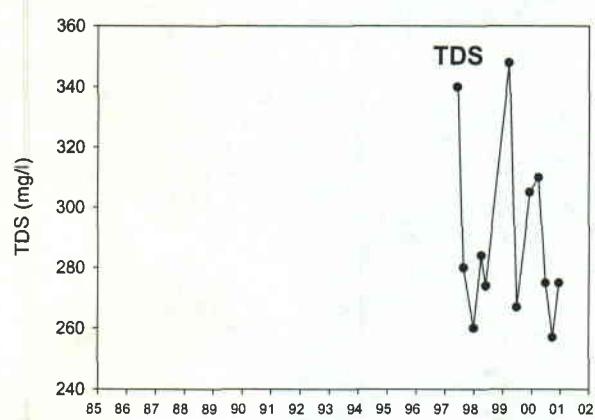
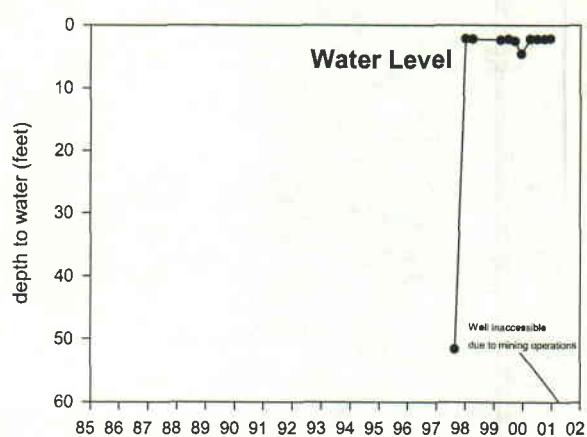
MW-6



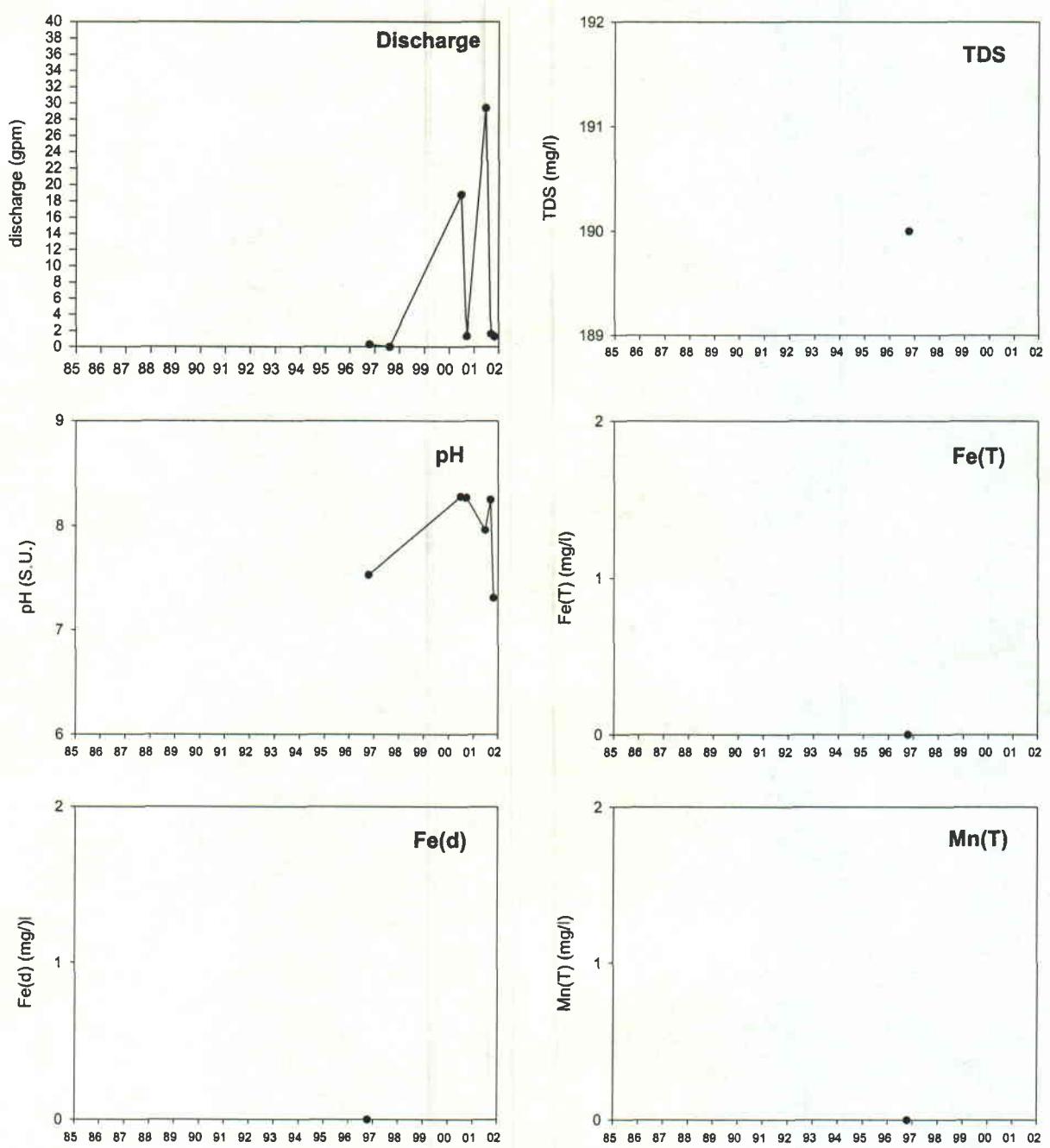
MW-6a



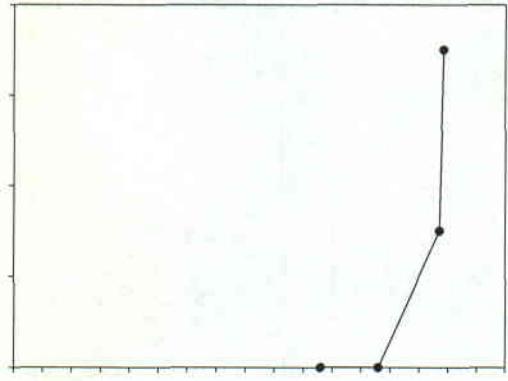
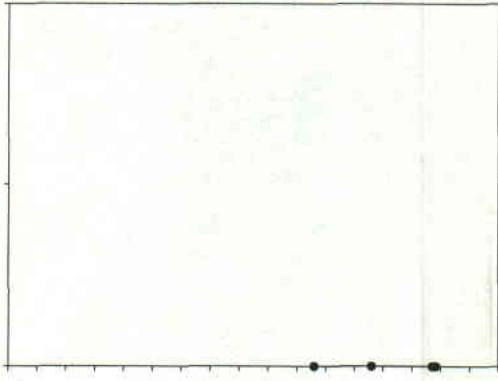
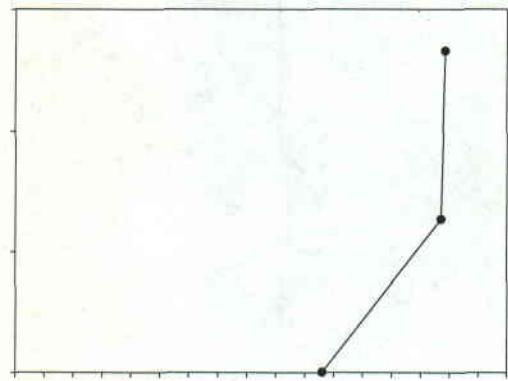
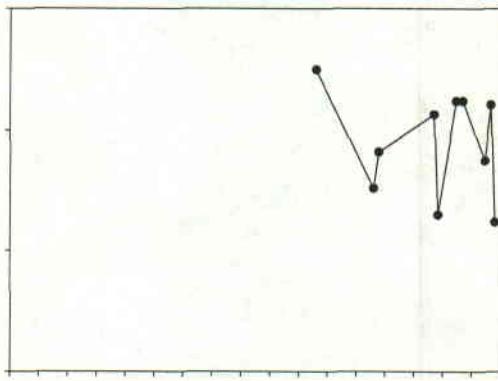
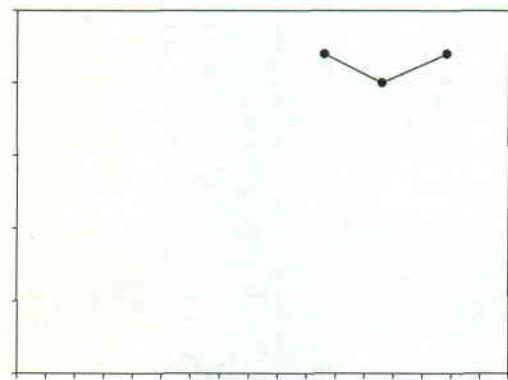
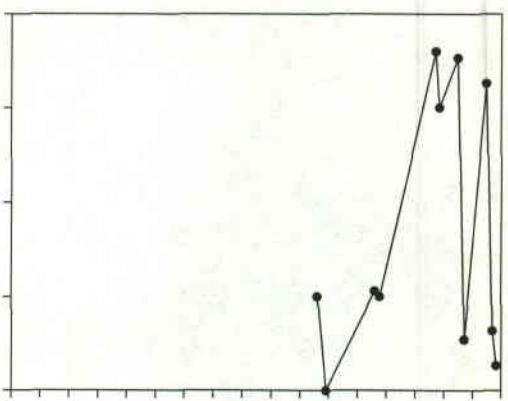
MW-7

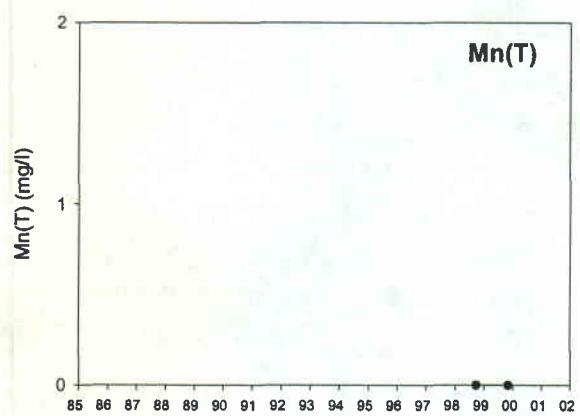
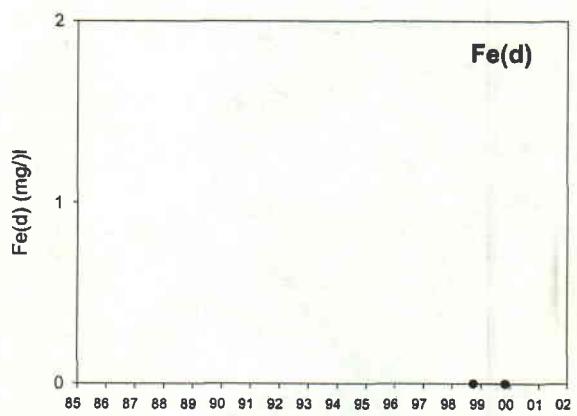
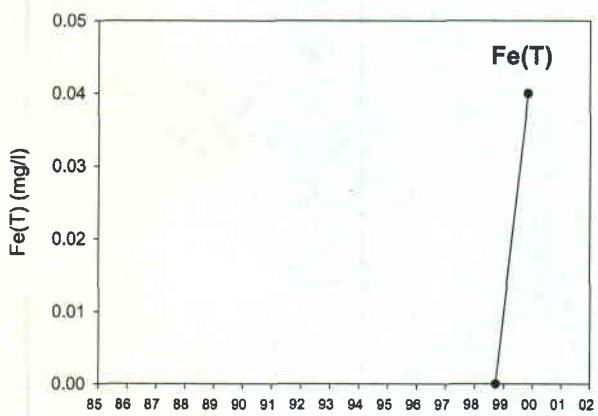
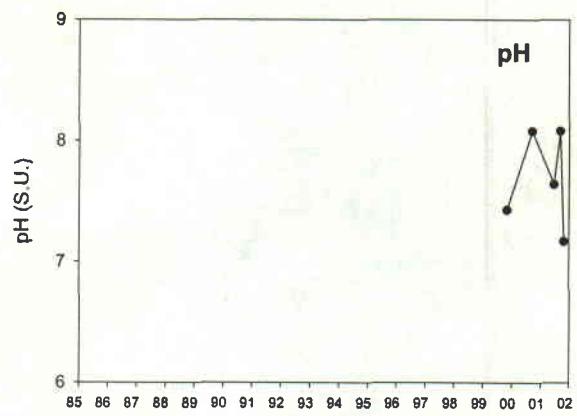
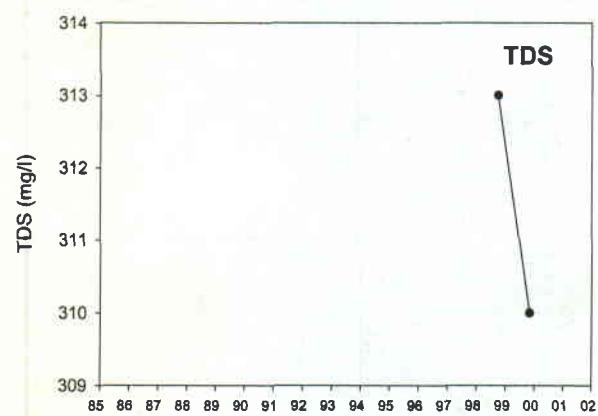
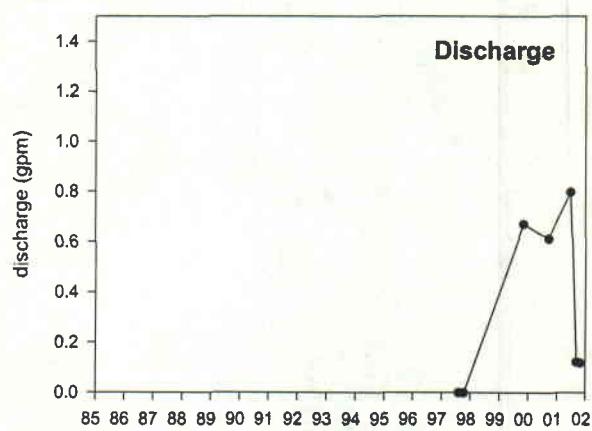


MW-8

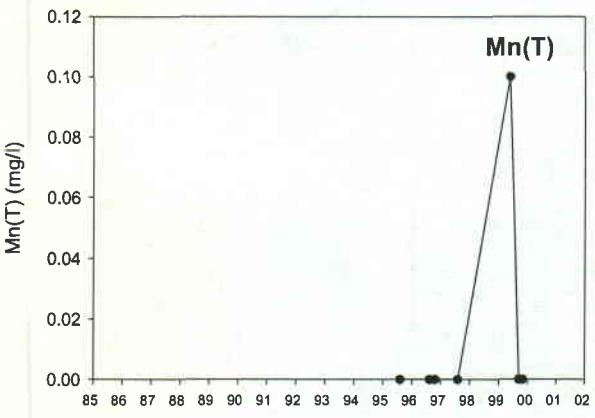
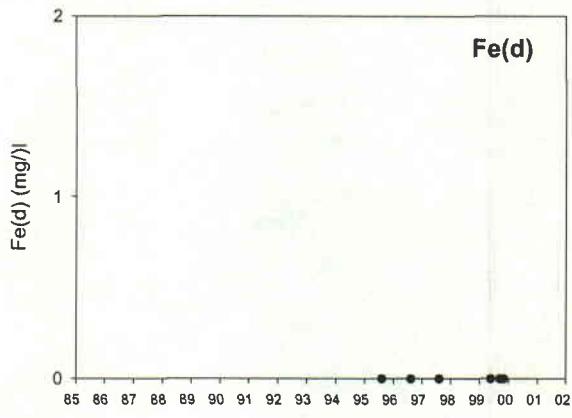
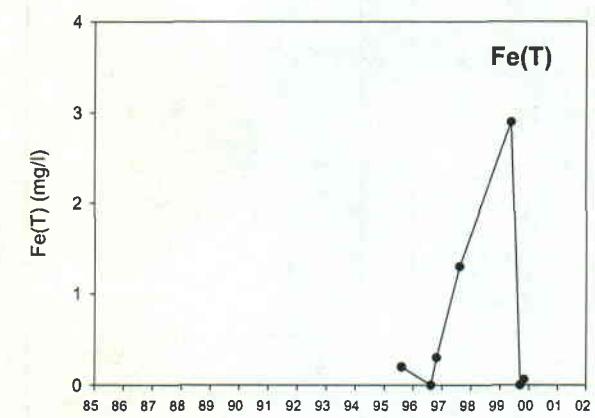
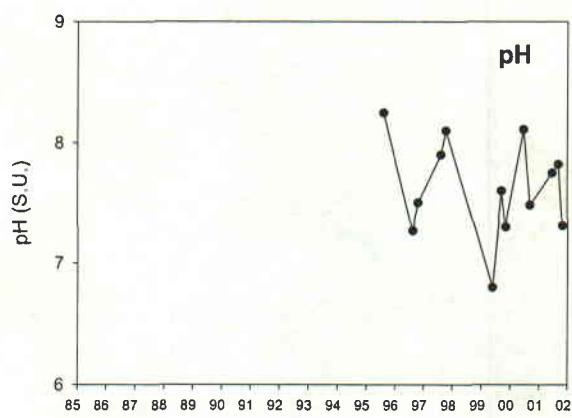
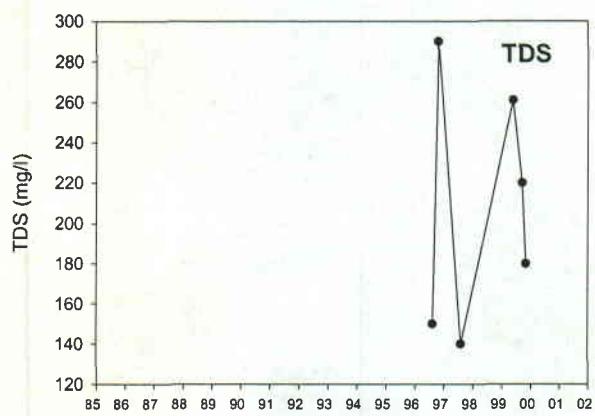
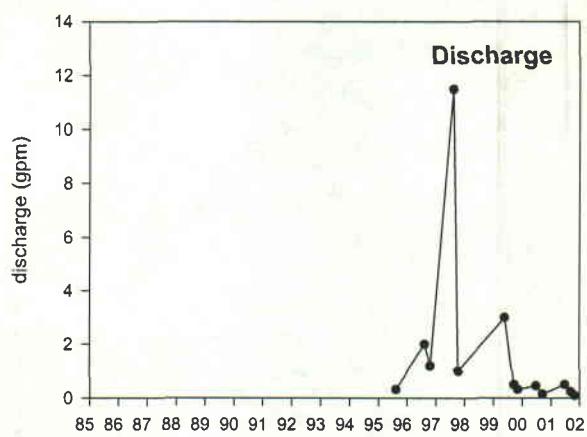


Spring SP1-19

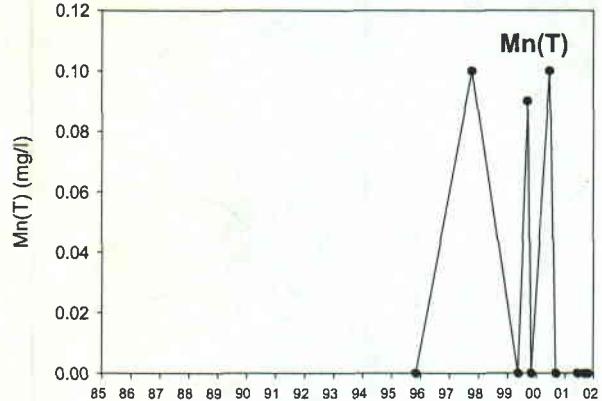
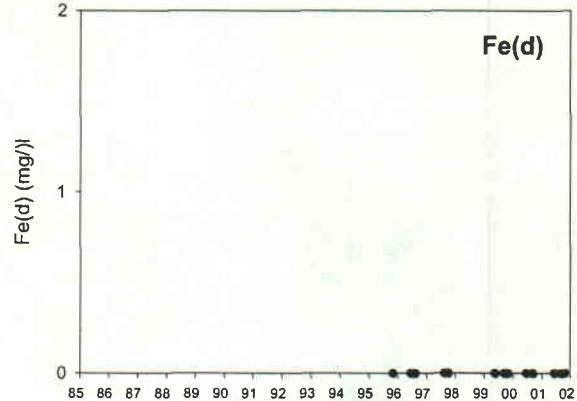
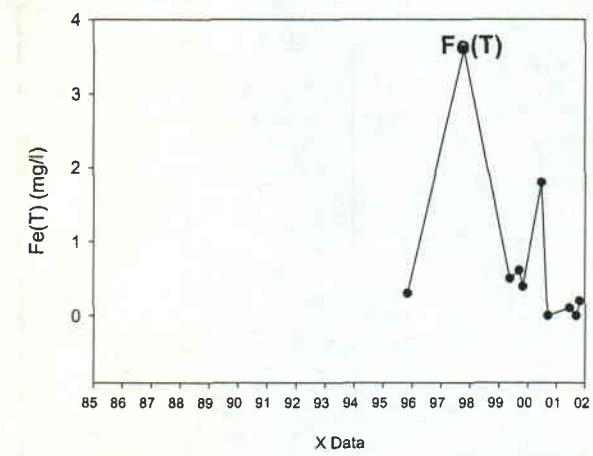
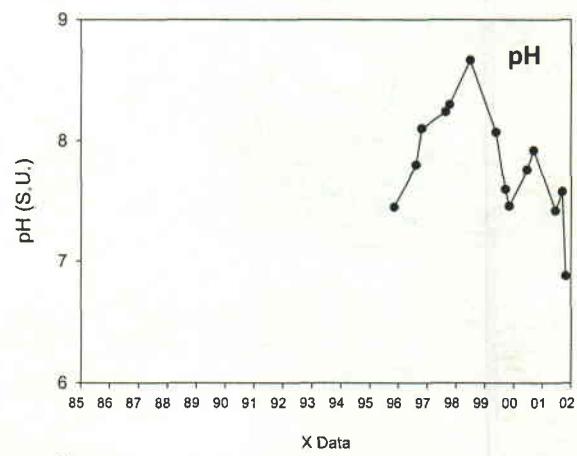
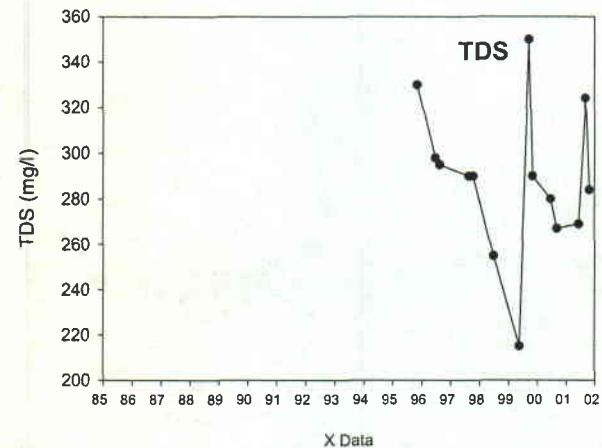
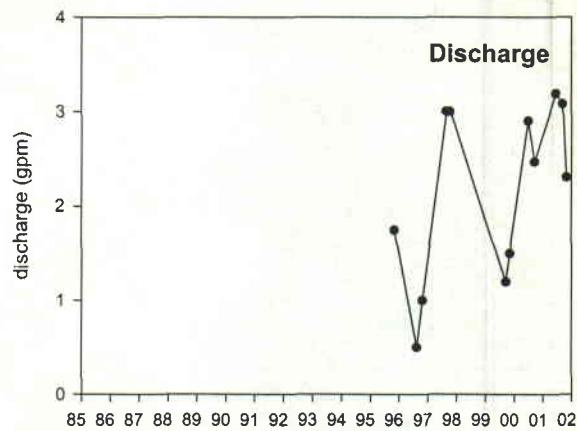




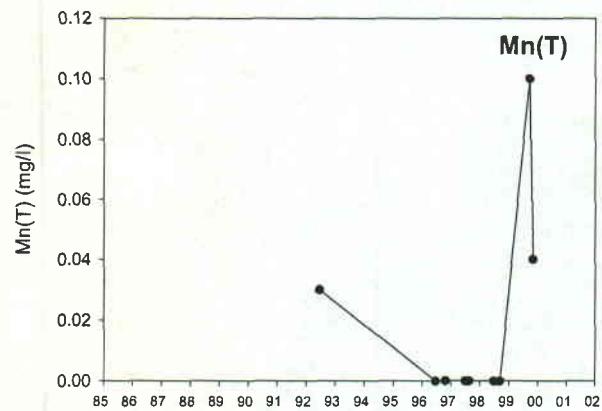
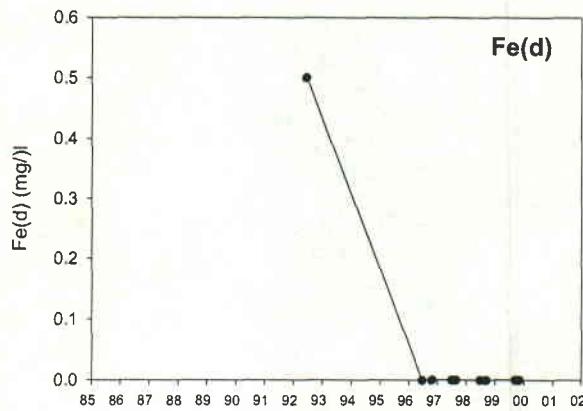
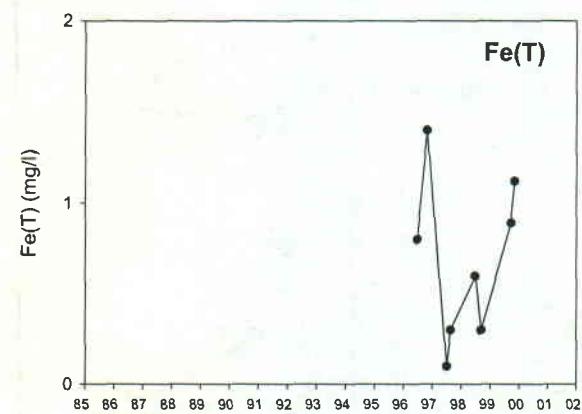
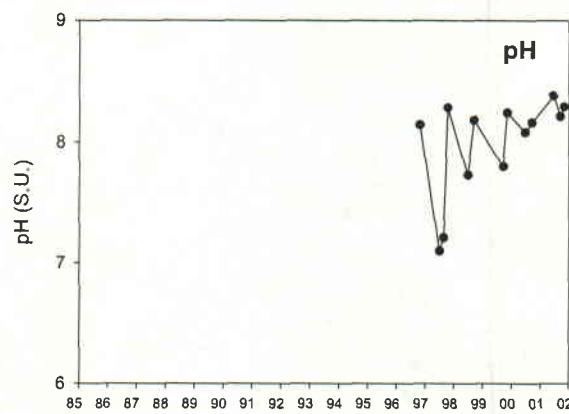
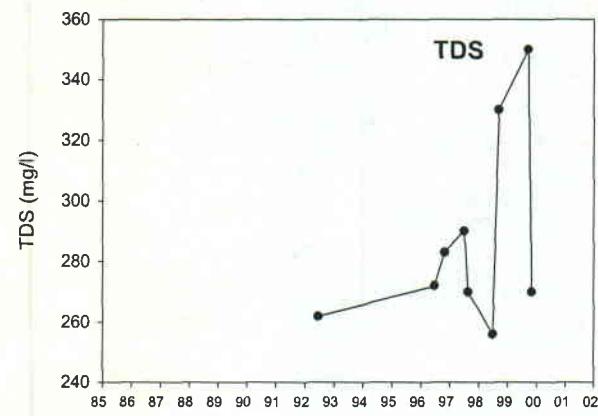
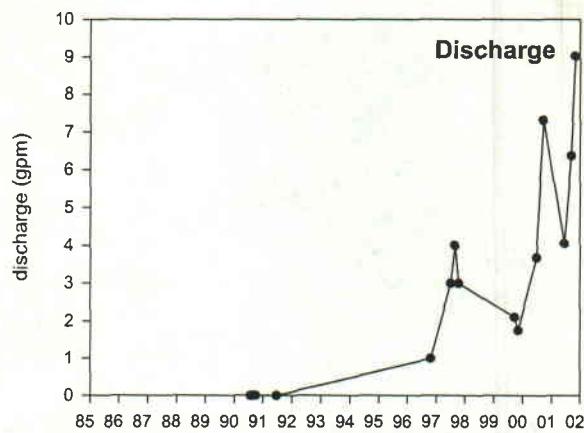
Spring SP1-24



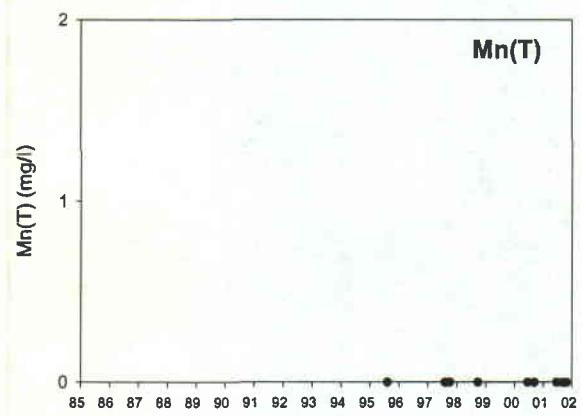
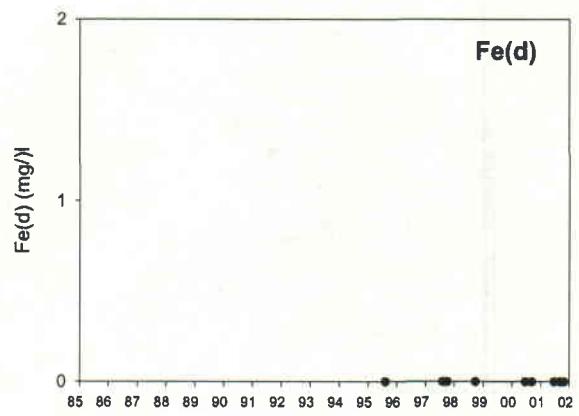
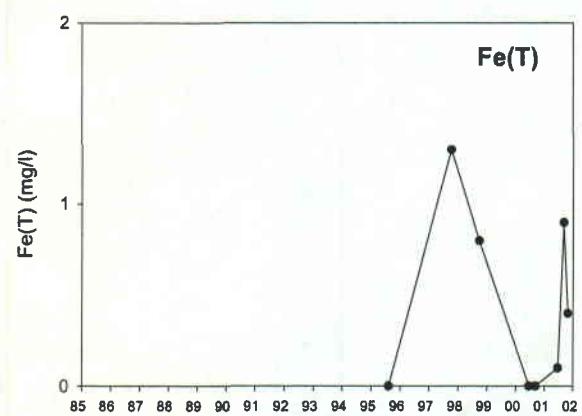
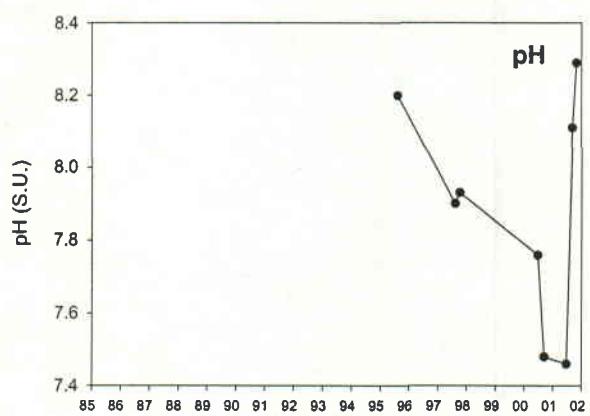
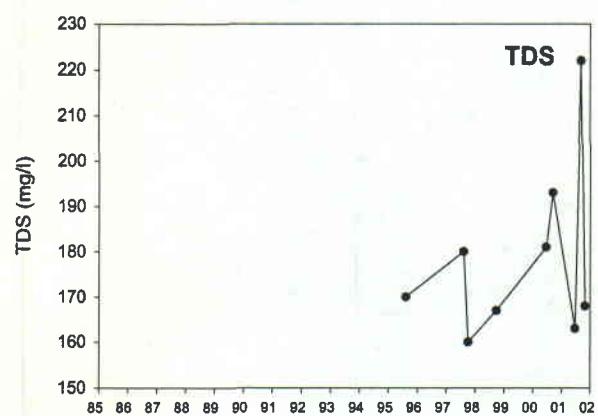
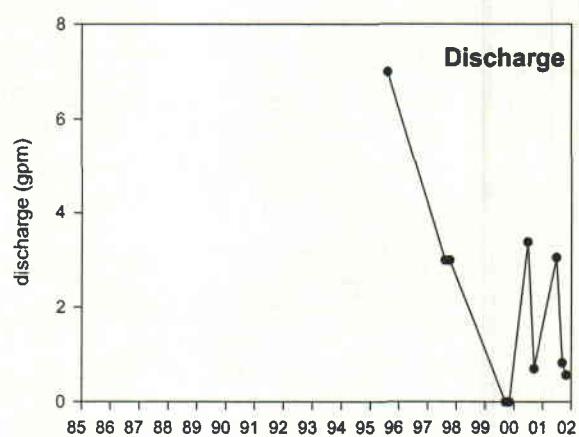
Spring SP1-3



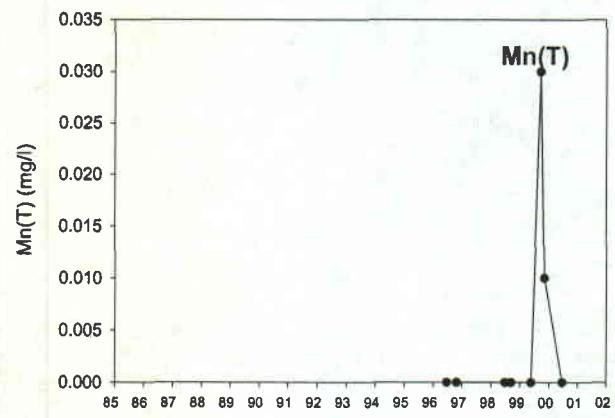
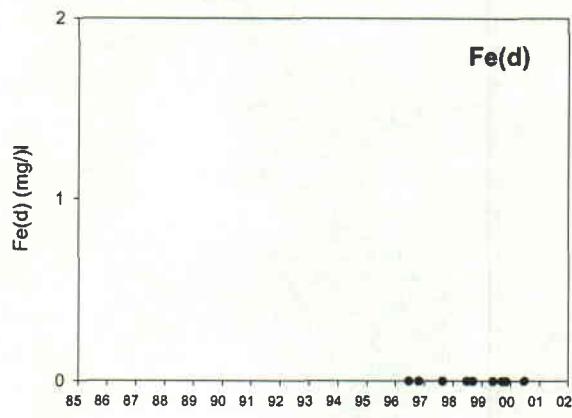
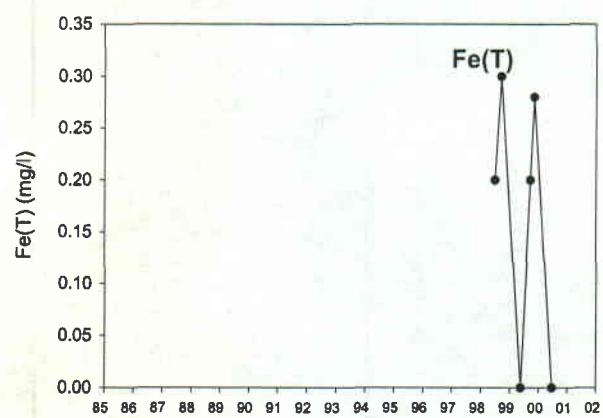
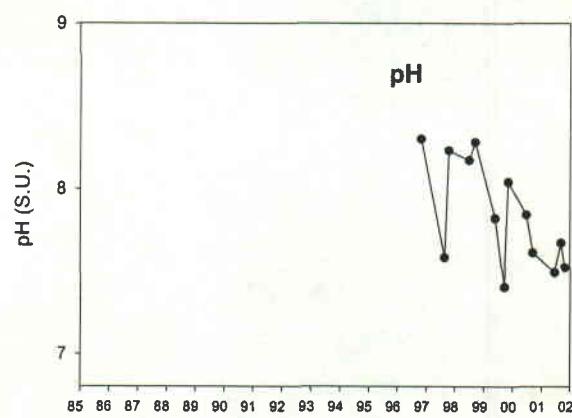
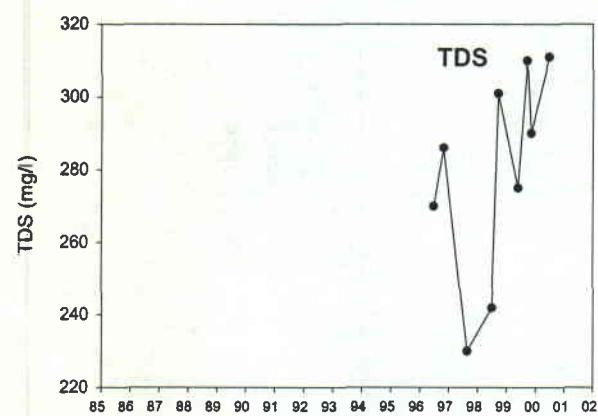
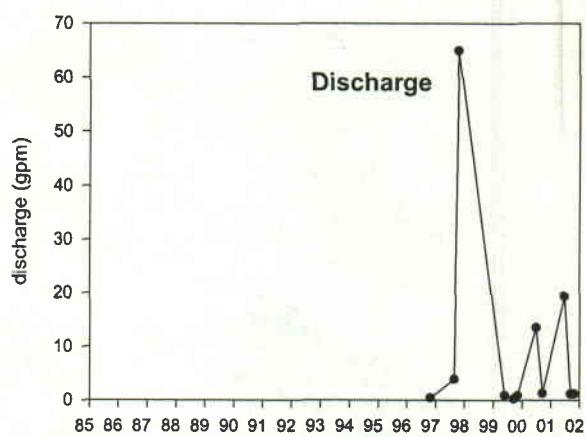
Spring SP1-33



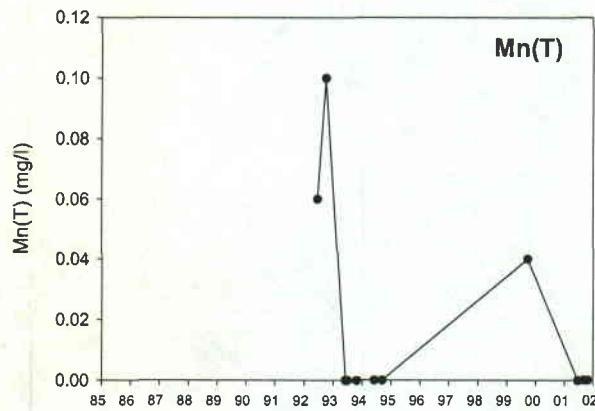
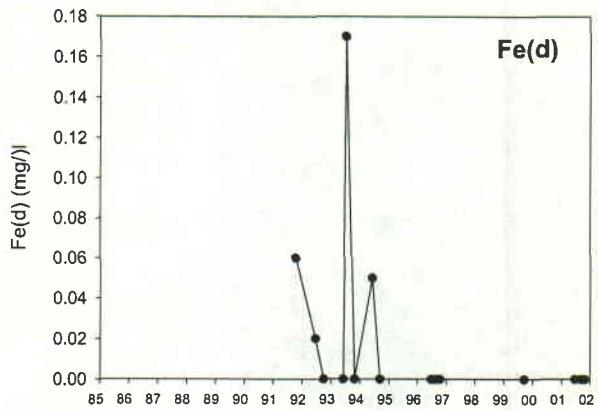
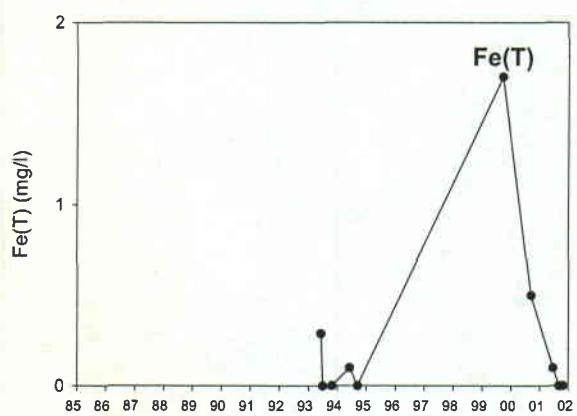
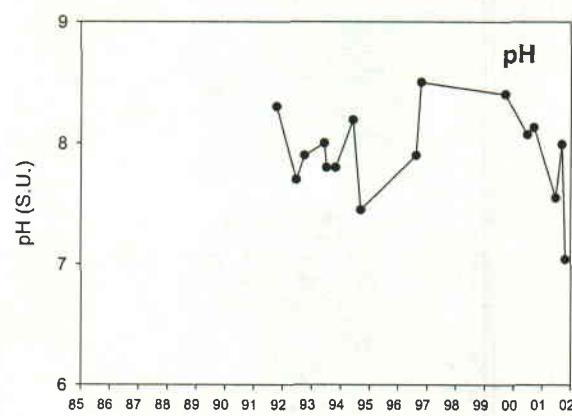
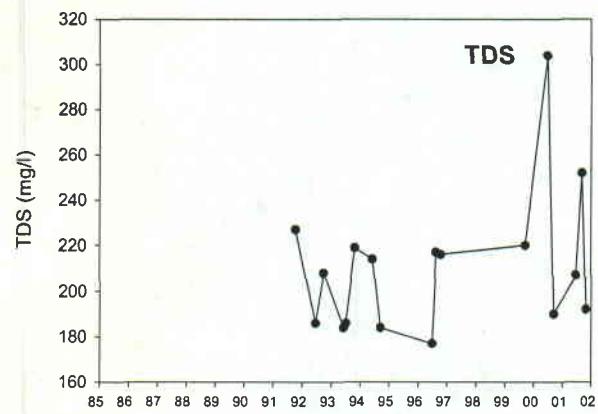
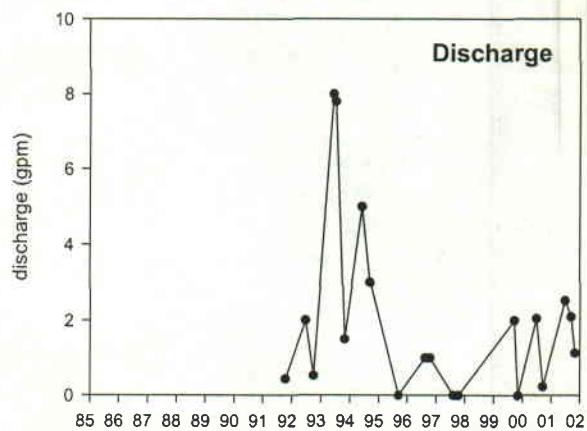
Spring SP1-47



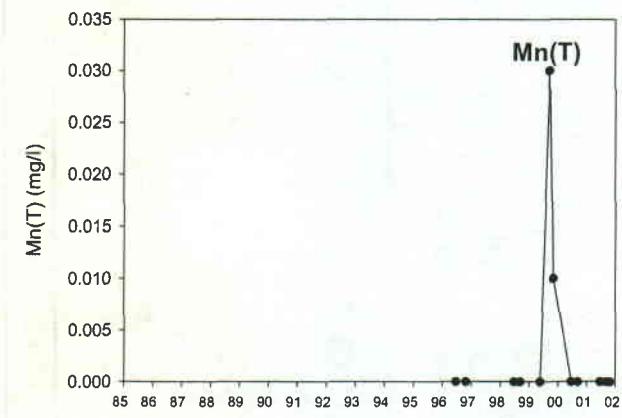
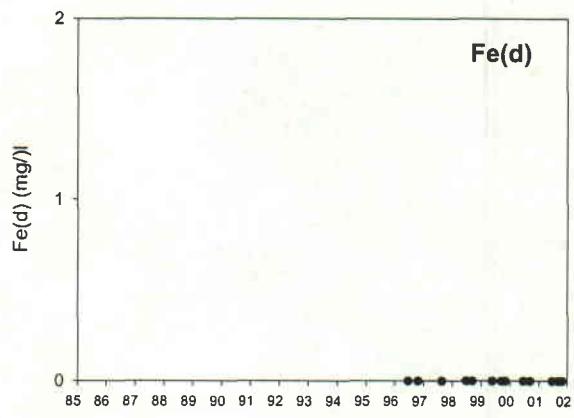
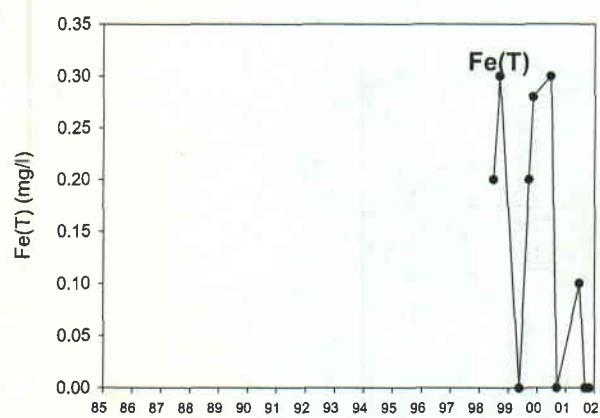
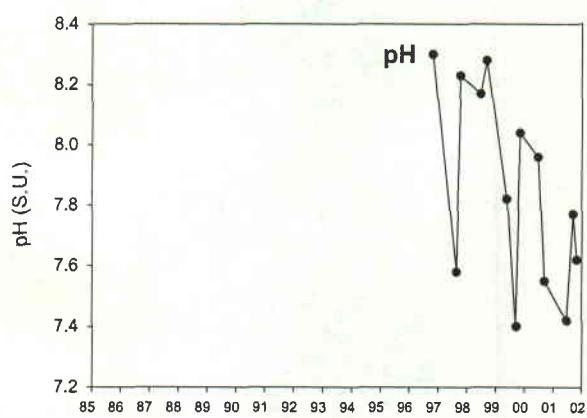
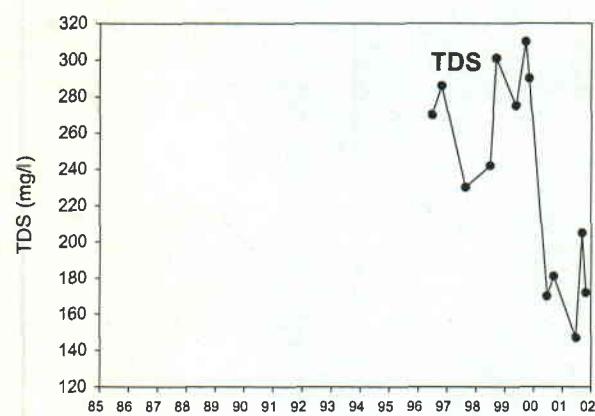
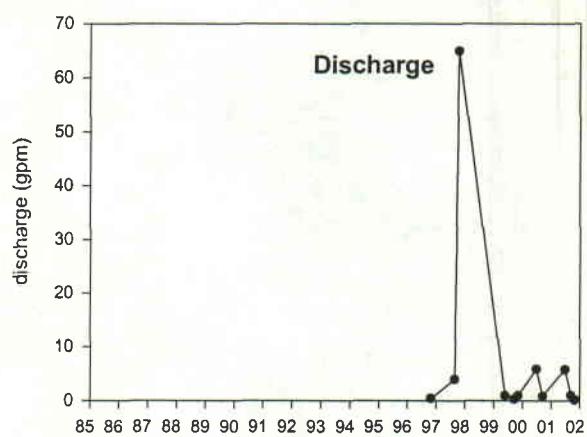
Spring SP1-9



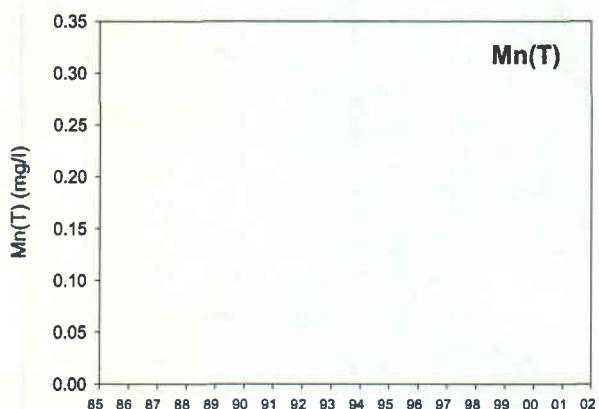
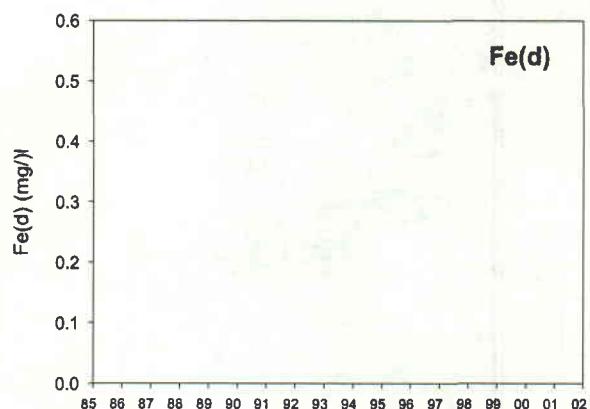
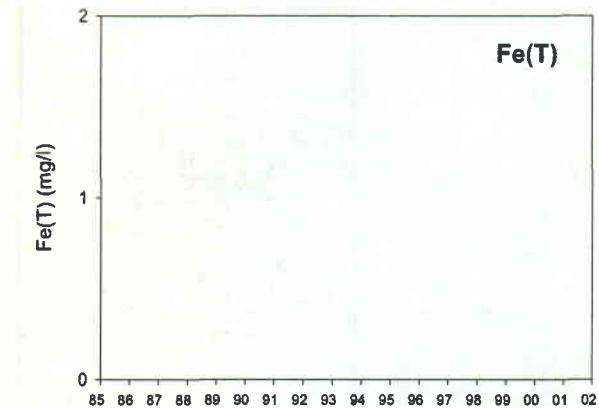
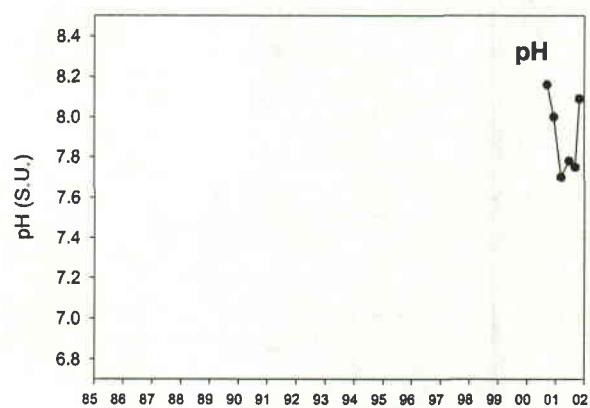
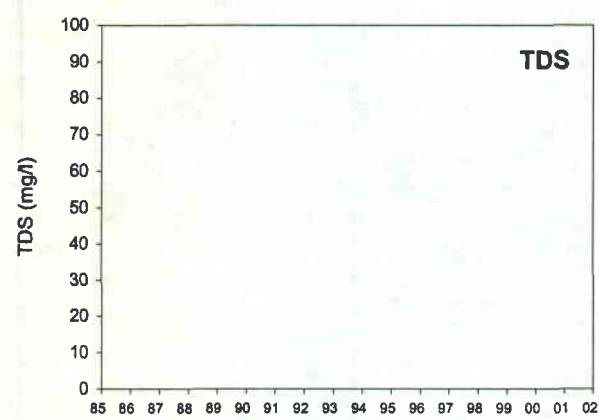
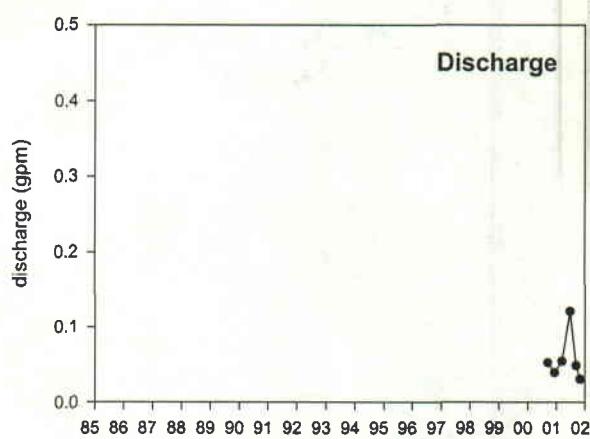
Spring SP2-1



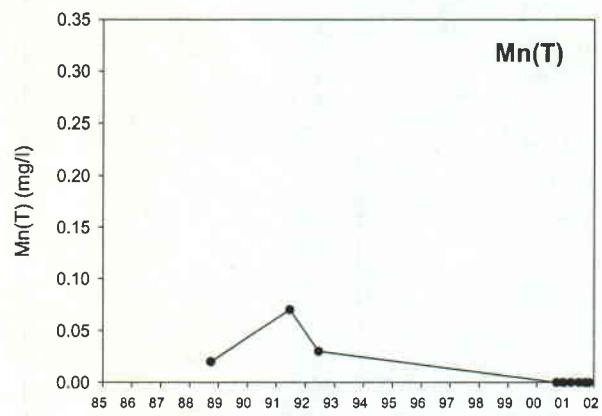
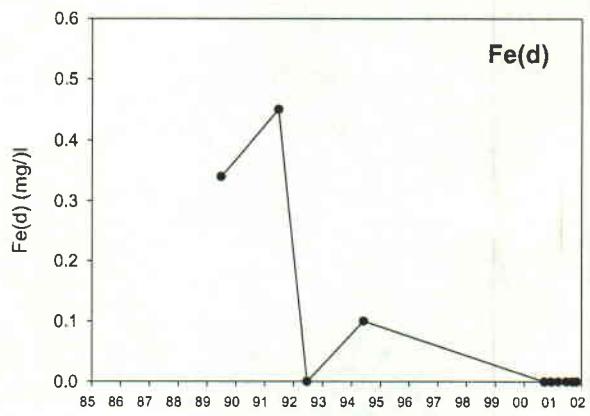
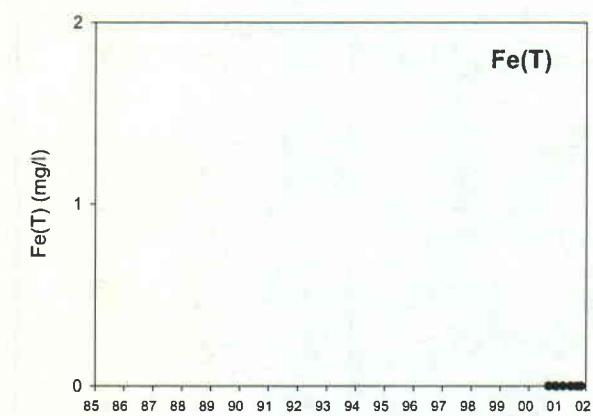
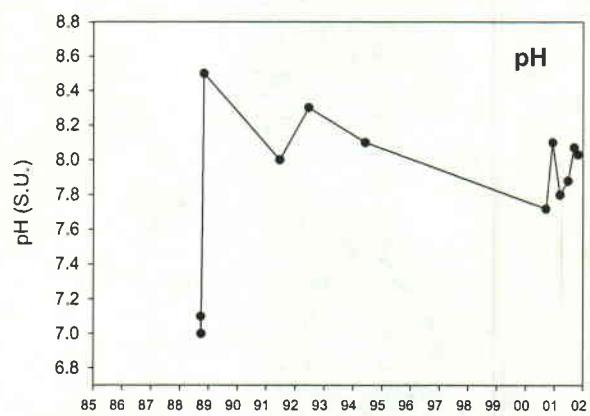
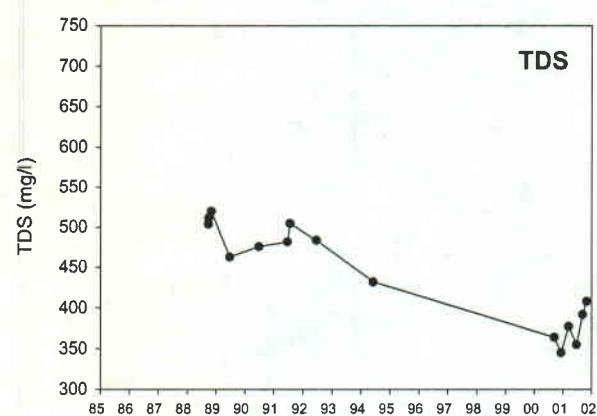
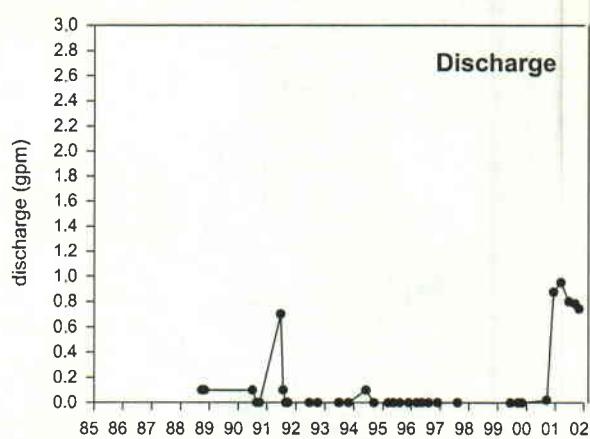
Spring SP2-24



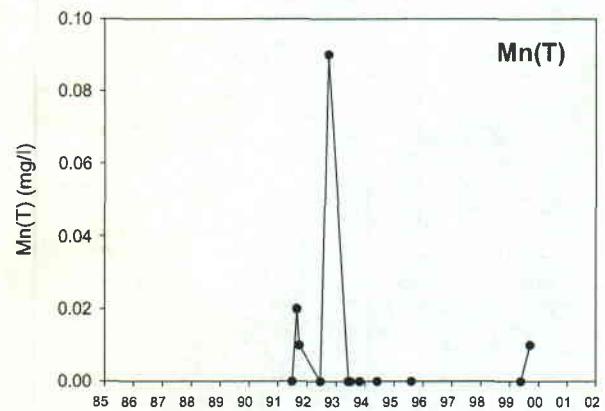
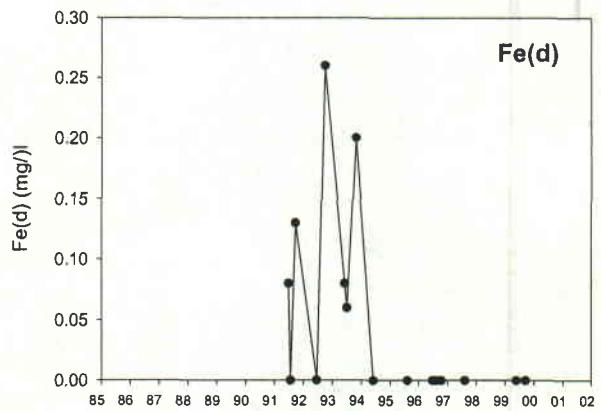
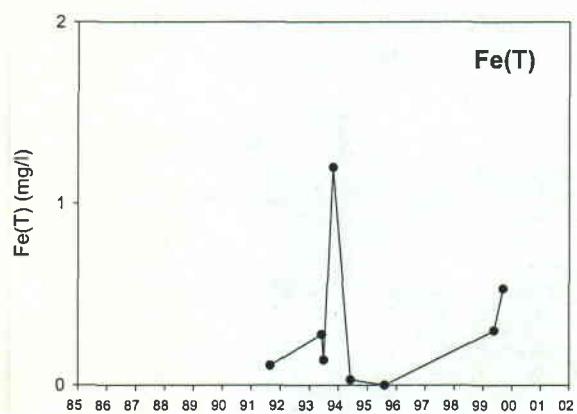
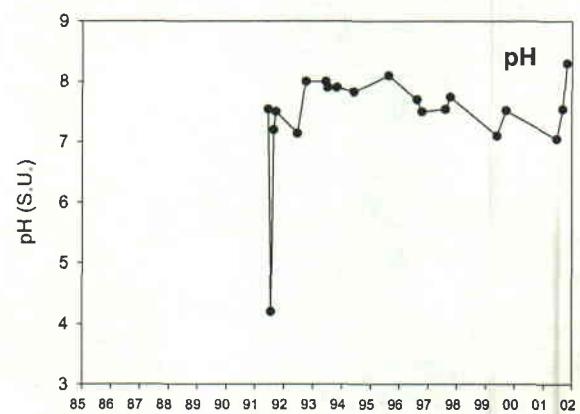
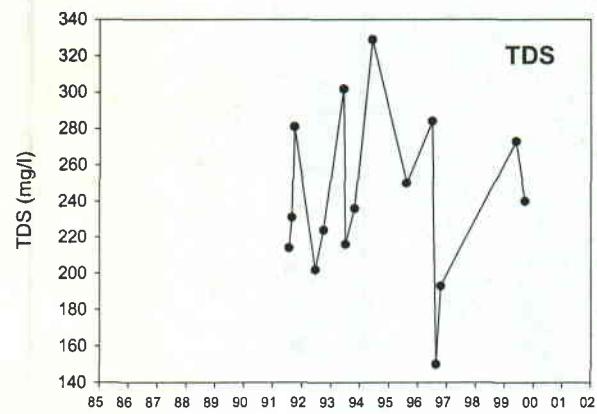
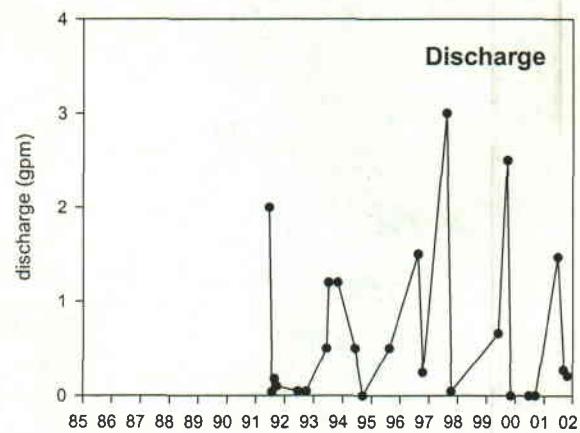
Spring SP2-9



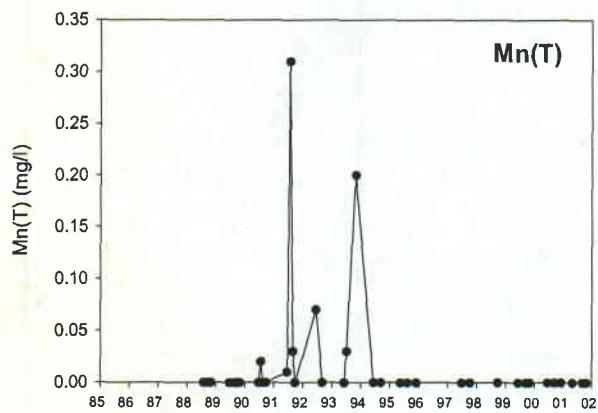
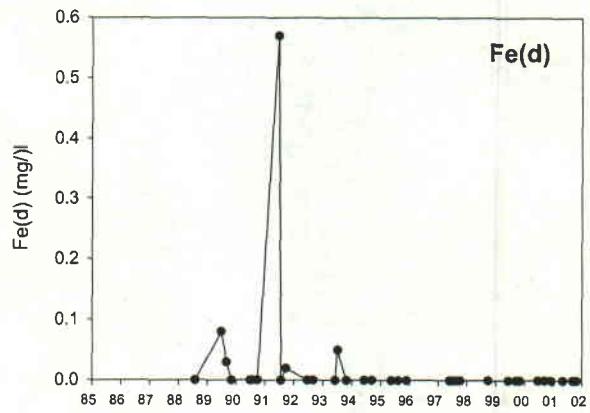
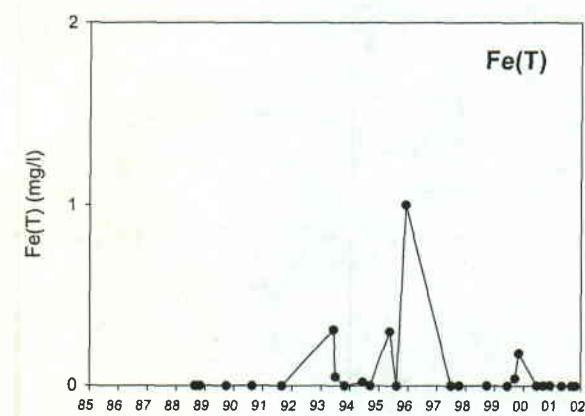
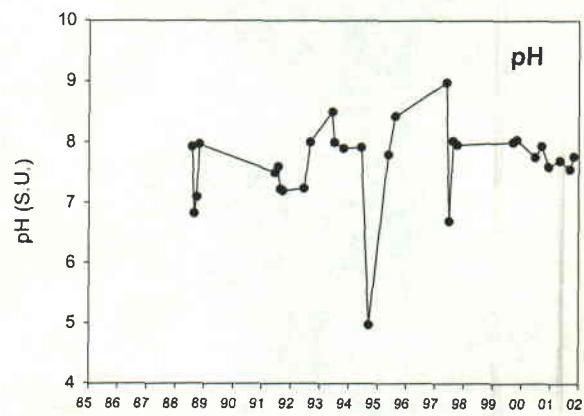
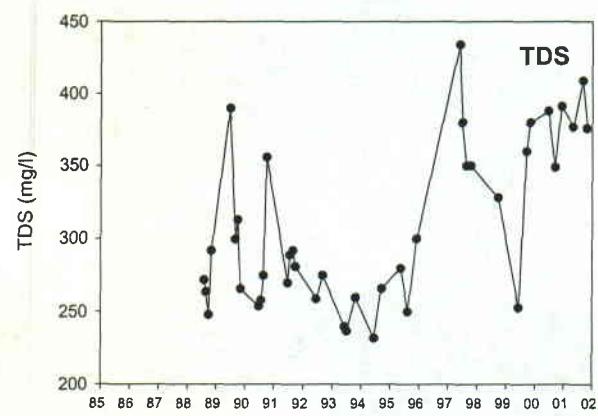
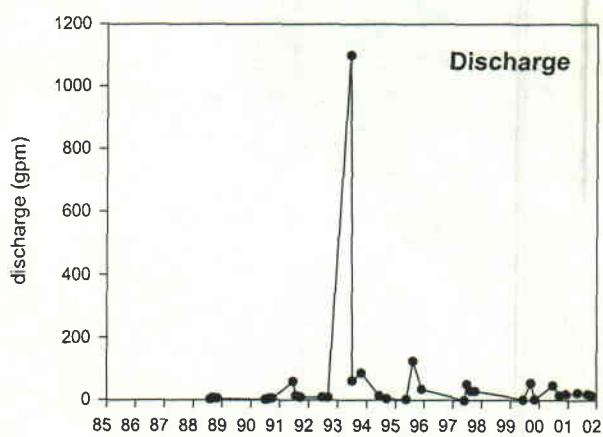
Spring SP-30



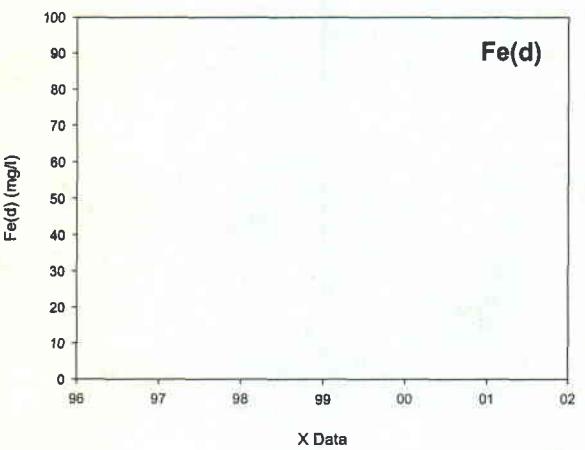
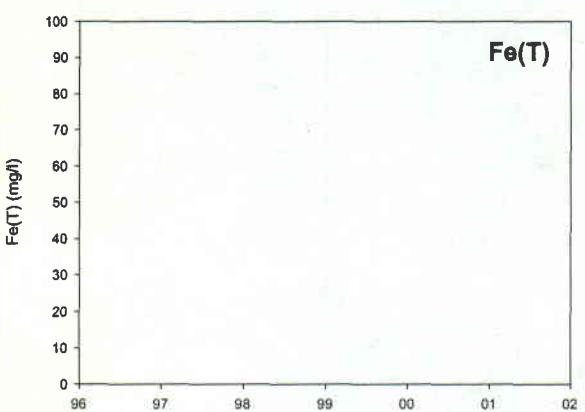
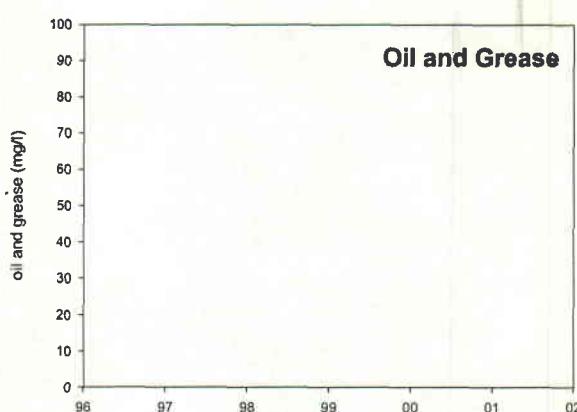
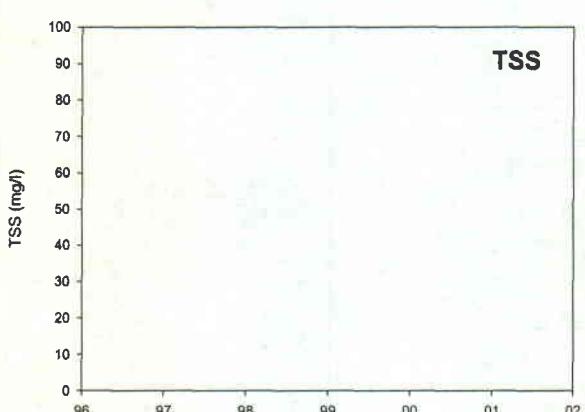
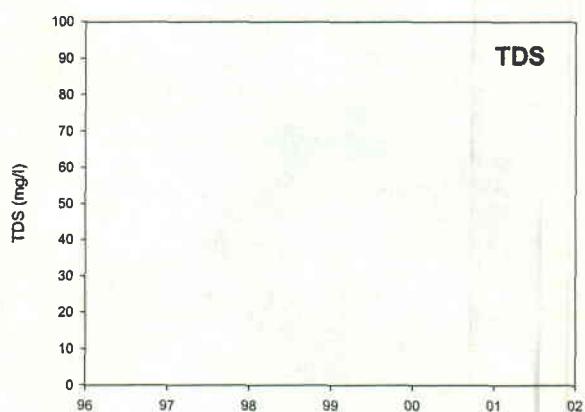
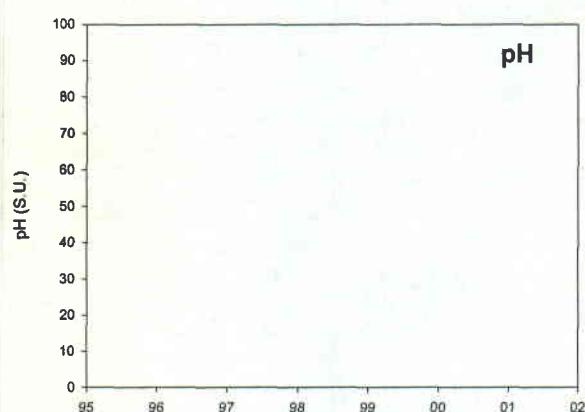
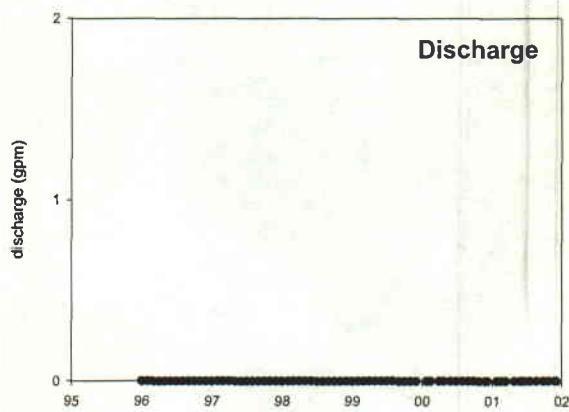
Spring SP-36



Spring SP-47a



Spring SP-58



Sediment Pond Discharge

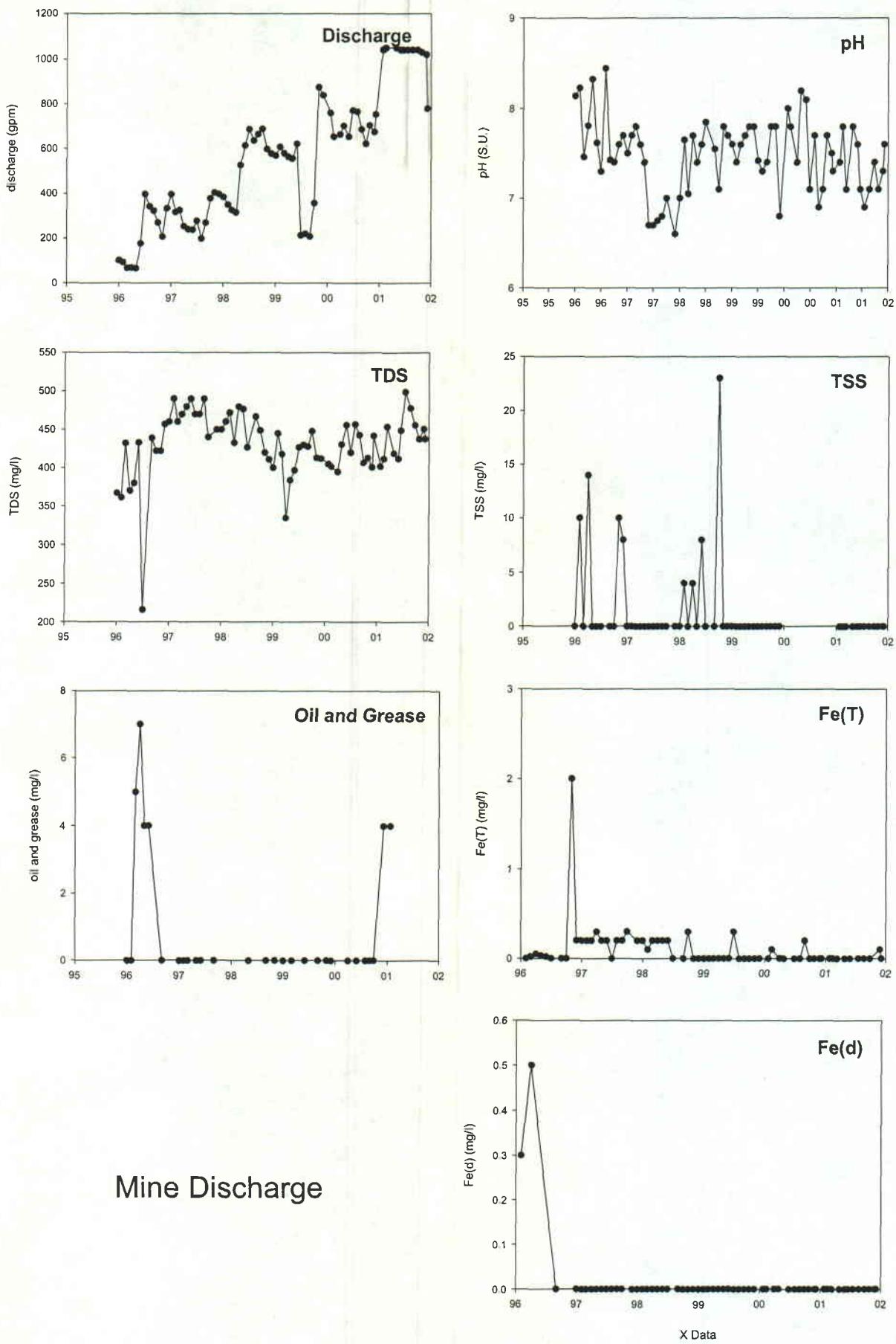


Table 1 Results of hydrologic monitoring at GENWAL's Crandall Canyon Mine permit area during 2001

In-Mine Monitoring Wells

DH-1		13-Mar-01	yes
		01-May-01	yes
		27-Sep-01	yes
		22-Dec-01	yes

DH-2	13-Mar-01 01-May-01 27-Sep-01 03-Dec-01	Inaccessible Inaccessible Inaccessible Inaccessible
------	--	--

01-May-01 yes 0

03-Dec-01 yes 0.3 10.9 8 476 274

MW-2 13-Mar-01 flooded
 01-May-01 flooded
 27-Sep-01 flooded

MW-3	MW-4
13-Mar-01	Inaccessible
01-May-01	Inaccessible
27-Sep-01	Inaccessible
03-Dec-01	Inaccessible
13-Mar-01	Inaccessible
01-May-01	Inaccessible
27-Sep-01	Inaccessible

MW-5 13-Mar-01 destroyed
 01-May-01 destroyed
 27-Sep-01 destroyed

Table 2 Solute compositions and discharge rates of streams, springs and wells in the GENWAL permit area.

surveys' latest revised for annual report 2000 site 31 Mar. 02

Streams	Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(T) mg/l	Fe(d) mg/l	Mn(T) mg/l	Mn(d) mg/l
L. Flume (Crandall Creek)	11-Mar-88	76.3	3.00	8.24	743	384	64.0	36.5	10.6	3.3	289	0	91.0	5.8	<0.05	<0.01		
	31-May-88	350.1	3.60	8.14	528	252	64.0	21.9	4.7	2.8	269	0	18.0	4.1	<0.05	0.02		
	30-Sep-88	58.3	9.90	7.68	483	256	60.0	25.5	6.9	1.6	267	16	38.1	5.6	<0.05	<0.01		
	02-Nov-88	62.8	6.80	8.40	670	330	60.0	42.6	8.6	2.5	298	0	73.3	4.2	<0.05	<0.01		
	31-Mar-89					298	56.5	29.4	5.8	1.4	259	7	0.0	20.0	0.03	<0.01		
	22-Jun-89					198	56.3	23.1	3.9	0.7	248	<1	28.0	25.0	<0.02	<0.01		
	28-Sep-89					32	57.6	32.2	5.3	0.4	314	<1	25.0	10.0	<0.02	<0.01		
	18-Dec-89					326	68.7	29.2	5.4	0.1	294	<1	40.0	10.0	0.06	<0.01		
	30-Jan-90					291	60.7	28.4	1.0	0.4	292	<1	33.0	10.0	<0.02	<0.01		
	18-Jan-90	4.5	3.10	7.20	450	291	60.7	28.4	1.0	0.4	292	<1	33.0	10.0	<0.02	<0.01		
	30-Jan-90					225	66.0	28.0	3.3	4.6	274	<1	35.0	20.0	<0.02	0.02		
	13-Apr-90	430.9	3.20	7.20	448	254	61.8	21.6	3.4	0.0	270	<1	28.0	10.0	<0.02	<0.01		
	14-Apr-90	502.7	3.30	7.20	448	189	70.5	30.5	5.6	0.0	363	<1	22.0	5.0	<0.02	<0.02	0.02	
	23-Jul-90					300	323	86.7	39.7	9.3	0.6	346	<1	43.0	70.0	0.03	0.39	
	24-Jul-90	103.2	4.80	7.60	300	318	69.0	28.1	5.0	0.5	252	<1	47.0	15.0	<0.02	<0.01		
	11-Oct-90					500	71.5	19.0	3.1	0.0	228	5	30.0	20.0	0.00	0.00		
	12-Oct-90					550	91.2	24.1	3.1	0.0	406	0	58.0	125.0	0.00	0.00		
	12-Jan-91	148.1	2.80	8.46	300	318	69.0	28.1	5.0	0.5	270	<1	52.0	15.0	0.09	0.09		
	14-Jan-91					500	74.6	24.9	4.1	0.0	326	0	50.0	10.0	0.44	0.06		
	04-Apr-91	148.1	1.40	8.00	330	513	265	71.5	19.0	3.1	0.0	228	5	30.0	20.0	0.00	0.00	
	21-Jul-91	538.6	4.90	7.20	500	564	99.7	28.9	75.1	1.0	301	0	100.0	15.0	0.10	0.05		
	11-Oct-91	237.8	7.00	8.26	600	564	99.7	28.9	75.1	1.0	311	0	60.0	164.0	0.12	0.00		
	08-Mar-92	44.9	3.33	7.60	400	564	93.4	35.5	10.3	1.3	281	<1	50.0	28.0	<0.2	<0.2	0.10	
	18-Jun-92	116.7	17.33	8.24	513	615	68.8	27.9	94.1	0.0	296	0	29.0	4.1	0.00	0.00		
	30-Sep-92	134.6	16.1	8.2	550	357	91.2	24.1	3.1	0.0	406	0	50.0	10.0	0.44	0.06		
	16-Dec-92	224.4	0.6	7.9	620	254	71.5	19.0	3.1	0.0	326	0	50.0	10.0	0.44	0.06		
	04-Mar-93	234.0	1.0	7.8	490	506	68.8	27.9	94.1	0.0	311	0	60.0	164.0	0.12	0.00		
	03-Jun-93	6500.0	12.0	8.1	300	244	57.8	20.2	4.8	0.6	248	0	19.0	4.9	0.28	<0.5	<0.03	
	01-Jul-93	290.0	10.0	8.1	540	249	57.7	21.3	5.7	0.1	253	0	24.0	5.3	<0.05	0.05	<0.03	
	25-Oct-93	380.0	7.0	7.2	440	368	59.0	32.0	9.0	<2	281	<1	50.0	28.0	<0.2	<0.2	0.10	
	09-Feb-94	220.0	29.4	7.3	506	265	46.0	35.0	4.5	1.7	296	0	29.0	4.1	0.00	0.00		
	15-Jul-94	30.0	57.2	7.6	610	301	46.0	30.0	21.0	1.9	246	0	46.0	31.0	0.09	0.21	<0.02	
	06-Sep-94	40.0	46.4	7.6	848	308	42.0	31.0	25.0	2.4	241	0	44.0	40.0	0.13	<0.05	<0.02	
	22-Nov-94	125.0	28.4	6.7	450	65.0	40.0	38.0	<5	290	0	50.0	68.0	<.2	<.2	<.2	<.2	

U. Flume (Crandall Creek)

Date	flow gpm	T °C	pH	Cond. µS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ mg/l	CO ₃ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(T) mg/l	Fe(d) mg/l	Mn(T) mg/l	Mn(d) mg/l
23-Jul-90	430.9	3.2	7.1	410	247	62.2	21.3	2.8	0.0	251	<1	32.0	15.0	<0.02	0.03		
24-Jul-90																	
11-Oct-90	170.5	5.2	7.5	300	261	63.4	22.4	2.0	0.0	279	<1	25.0	10.0	<0.02	<0.02	0.02	
12-Oct-90																	
12-Jan-91																	
14-Jan-91																	
04-Apr-91	368.0	1.4	8.0	400	290	67.9	24.8	2.9	0.0	252	<1	33.0	25.0	<0.02	<0.02	<0.01	
21-Jul-91	852.7	5.1	7.0	500	234	56.5	22.9	2.8	1.8	261	<1	23.0	5.0	<0.02	<0.02	0.05	
11-Oct-91	273.8	8.0	8.5	600	262	67.7	25.9	3.0	0.0	263	<1	36.0	10.0	0.05			
08-Mar-92	67.3	1.1	7.5	300	320	72.2	22.2	3.2	0.0	274	0	32.0	20.0	0.00	0.00		
18-Jun-92	161.6	16.8	8.2	517	250	53.5	26.8	1.4	0.0	217	5	27.0	10.0	0.00	0.00		
30-Sep-92	94.3	13.3	8.2	600	288	63.9	23.7	1.3	0.0	224	0	28.0	20.0	0.13	0.00		
04-Mar-93	68.7	0.8	7.9	440	611	56.7	25.7	3.2	1.4	306	0	60.0	3.3	1.20	0.14	0.00	
03-Jun-93	5386.0	3.0	8.2	300	245	60.3	18.0	3.0	0.2	244	0	18.0	3.9	0.34	<0.05	<0.03	
01-Jul-93	129.0	9.4	8.1	427	231	54.8	20.0	23.1	<0.10	247	0	26.0	2.3	<0.05	<0.03		
25-Oct-93	147.0	6.0	7.9	440	297	56.0	28.0	4.0	<2.0	194	<1	28.0	6.0	<0.20	<0.20	<0.10	
09-Feb-94	168.0	32.0	7.2	409	55.0	44.0	39.0	1.7	312	3							
15-Jul-94	70.0	55.4	7.6	430	228	44.0	26.0	4.1	1.1	227	0						
06-Sep-94	50.0	41.0	7.6	613	225	41.0	25.0	5.0	<10	241	0						
22-Nov-94	125.0	28.4	6.8	280	58.0	30.0	<5	260	<1								
10-Mar-95	180.0	0.6	7.9	450	280	55.0	30.0	6.0	2.0	245	10	25.0	6.0	<0.1	<0.1	<0.1	
16-May-95	522.0	8.0	8.0	490	260	60.0	31.0	5.0	1.0	250	20	38.0	10.0	0.30	<0.1	<0.1	
10-Aug-95	254.0	11.0	8.9	467	230	56.0	23.0	5.0	<1	248	13	27.0	55.0	<0.1	<0.1	<0.1	
28-Nov-95	417.7	6.0	9.2	432	290	62.0	27.0	5.0	<1	250	15	31.0	20.0	<0.1	<0.1	<0.1	
26-Mar-96	150.0	1.0	8.0	580	322	61.0	30.0	4.0	<3	314	<2	38.0	5.0	0.19	<0.3	<0.4	
26-Jun-96																	
16-Aug-96	15.0	14.0	8.3	499	261	55.0	29.0	5.0	<1	232	25	29.0	7.0	<0.1	<0.1	<0.1	
24-Oct-96	2.0	3.0	8.2	564	312	60.0	34.0	6.0	1.0	326	<5	38.0	7.0	<0.1	<0.1	<0.1	
25-Mar-97	11.2	3.0	8.4	730	370	59.9	35.0	4.7	1.6	293	<1	50.6	3.9	<0.005	<0.05		
05-May-97	47.0	6.0	9.0	656	314	59.9	35.0	4.7	1.6	293	<1	50.6	3.9	<0.02	<0.05		
20-Aug-97	673.2	8.0	7.7	502	310	31.0	5.0	1.0	301	<5	48.0	4.0	270.00	<0.1	<0.1		
01-Oct-97	507.1	6.0	7.9	641	320	68.0	32.0	5.0	<1	352	<5	48.0	4.0	<0.1	<0.1	<0.1	
08-Sep-98																	
04-Mar-99	367.0	3.0	8.1	380	344	71.0	37.0	5.0	2.0	356	<5	79.0	4.0	<0.1	<0.1	<0.1	
10-Jun-99	4173.0																
15-Sep-99	467.0	7.2	8.0	480	370	62.1	35.2	4.4	1.4	283	<1	57.0	7.0	0.09	<0.02	0.01	
04-Nov-99	305.0	12.0	7.9	479	340	61.0	40.6	4.2	1.7	313	<1	63.0	7.0	0.05	<0.02	<0.01	
20-Jun-00	950	8.7	8.31	479	304	59	27	3	<1	270	<5	45	2	<0.1	<0.1	<0.1	

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fed mg/l	Mn(T) mg/l	Mn(d) mg/l
14-Sep-00	321	9.2	8.06	557	325	60	34	5	2	281	<5	76	3	<0.1	<0.1	<0.1
09-Dec-00	350	-0.3	8.26	590	333	66	36	4	1	324	<5	73	2	<0.1	<0.1	<0.1
13-Mar-01	234	3.6	7.8	583	383	62	37	4	1	311	<5	84	2	<0.1	<0.1	<0.1
01-May-01	383	10.8	7.9	567	336	63	38	4	1	303	<5	81	3	<0.1	<0.1	<0.1
09-Sep-01	367	9.3	8.36	549	419	69	37	5	1	284	<5	124	3.1	<0.1	<0.05	<0.05
29-Oct-01	262	3.7	8.39	592	406	71	39	5	2	306	<5	98.9	3	<0.1	<0.05	<0.05
Blind cyn flume																
12-Jan-91																
14-Jan-91																
04-Apr-91																
21-Jul-91																
11-Oct-91																
08-Mar-92																
18-Jun-92																
30-Sep-92																
16-Dec-92																
03-Jun-93	1.0	4.5	8.4	300	234	52.5	19.3	1.8	<0.10	246	0	11.0	3.1	0.53	0.06	<0.03
01-Jul-93	1.0	10.1	7.8	517	245	49.2	21.6	21.2	<0.10	257	0	18.0	3.6	1.35	0.06	<0.03
25-Oct-93	0.0															
15-Jul-94	dry															
06-Sep-94																
16-May-95	147.0	9.0	8.4	610	300	61.0	33.0	4.0	2.0	265	25	24.0	5.0	1.00	<0.01	<0.1
09-Aug-95	0.0															
28-Nov-95	0.0															
05-May-97	0.0															
15-Aug-97	0.0															
09-Oct-97	0.0															
08-Sep-98																
15-Sep-99	26.0	10.0	8.1	580	450	54.1	61.2	10.2	2.0	378	9	56.0	11.0	0.04	<0.02	<0.01
04-Nov-99	1.0	11.0	8.2	517	380	51.2	64.1	9.6	2.0	389	<1	55.0	11.0	0.06	<0.02	<0.01
20-Jun-00	173	13.9	8.61	482	290	51	32	2	1	289	<5	29	2	0.1	<0.1	<0.1
14-Sep-00	54	10.1	8.27	514	303	49	37	4	2	312	<5	25	3	0.1	<0.1	<0.1
08-Dec-00	10	-0.4	8.4	511	337	56	38	4	1	356	<5	30	3	0.3	<0.1	<0.1
14-Mar-01	50	0	8.3	500	337	54	40	5	1	354	<5	34	3	<0.1	<0.1	<0.1
02-May-01	488	3.3	8.6	422	261	54	28	2	<1	267	11	21	2	0.4	<0.1	<0.1
09-Sep-01	24.8	7.6	8.43	458	324	50	35	4	1	312	<5	28	3.2	<0.1	<0.1	<0.05
29-Oct-01	39.9	3.4	8.54	511	347	55	38	4	1	332	<5	31.7	3.2	<0.1	<0.1	<0.05

Date	flow gpm	T °C	pH	Cond. µS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	F _e (T) mg/l	F _e (d) mg/l	Mn(T) mg/l	Mn(d) mg/l
Horse Canyon																
22-Nov-94	6.0	-2.0	6.8	340	65.0	40.0	7.0	<5	290	0	50.0	8.0	2.00	<.2	<.2	
16-May-95	387.0	9.0	8.3	440	58.0	30.0	5.0	1.0	240	30	21.0	1.0	0.70	<0.1	<0.1	
09-Aug-95	72.0	10.0	8.1	765	280	50.0	33.0	7.0	1.0	274	17	25.0	6.0	0.20	<0.1	<0.1
28-Nov-95	15.9	9.0	8.9	436	280	62.0	35.0	6.0	1.0	280	25	30.0	7.0	0.10	<0.1	<0.1
26-Mar-96	280.0	1.0	7.9	340	128	57.0	35.0	6.0	1.1	350	<2	28.0	10.0	0.18	<.03	<.04
13-Jun-96				203	45.0	16.0	3.0	<1	212	12	<1	5.0	<1	<0.1	<0.1	
12-Aug-96	7.0	14.0	8.0	509	270	41.0	36.0	6.0	1.0	245	17	30.0	7.0	<1	<0.1	<0.1
24-Oct-96	3.0	0.0	8.9	584	301	55.0	37.0	6.0	1.0	331	<5	16.0	7.0	<1	<0.1	<0.1
25-Mar-97	12.6	3.0	8.6	789	410	59.1	41.2	6.1	1.5	344	<1	34.8	6.1	0.23	<0.2	0.02
05-May-97	64.0	5.0	8.7	608	284	57.1	30.4	4.3	1.0	279	4	21.6	3.9	0.21	<0.02	0.01
20-Aug-97	60.0	9.0	7.8	438	270	45.0	27.0	4.0	<1	<10	<5	17.0	<0.1	<0.1	<0.1	
07-Oct-97	179.5	7.0	8.0	473	260	63.0	30.0	4.0	<1	321	<5	16.0	5.0	0.20	<0.1	<0.1
08-Sep-98			8.5	557	346	62.0	38.0	7.0	2.0	276	31	43.0	5.0	0.50	<0.1	<0.1
10-Jun-99	337.0			229	57.0	22.0	3.0	<1	250	<5	13.0	2.0	0.2	<0.1	<0.1	
15-Sep-99	860.0	7.0	8.1	400	410	61.5	42.3	8.6	1.9	320	<1	58.0	8.0	0.11	<0.02	0.02
04-Nov-99	352.0	10.0	8.3	502	400	55.4	46.4	8.4	2.2	353	<1	60.0	8.0	0.17	<0.02	0.01
20-Jun-00	235	15.9	8.33	522	321	56	32	5	1	303	<5	43	3	0.1	<0.1	<0.1
14-Sep-00	80	11.6	8.21	675	422	64	44	13	3	308	12	108	5	<0.1	<0.1	<0.1
08-Dec-00	75	0	8.4	622	399	67	42	10	2	339	<5	96	4	0.2	<0.1	<0.1
14-Mar-01	102	0.7	8.2	594	415	65	43	9	2	340	<5	88	5	<0.1	<0.1	<0.1
02-May-01	970	3.2	8.5	372	238	49	22	2	<1	217	8	22	2	0.6	<0.1	<0.1
09-Sep-01	68	10	8.42	674	527	75	49	15	3	330	<5	170	6.9	<0.1	<0.1	<0.05
29-Oct-01	69.3	4.3	8.49	719	516	80	50	14	2	361	<5	150.8	5.7	0.1	<0.1	<0.05
Indian Creek																
26-Jun-96				290	67.0	19.0	3.0	<1	302	9	5.0	2.0	<0.1	<0.1	<0.1	
16-Aug-96	673.2	12.0	7.4	465	260	68.0	22.0	3.0	<1	293	9	4.0	4.0	<0.1	<0.1	<0.1
24-Oct-96	1570.8	3.0	8.4	724	262	67.0	22.0	3.0	1.0	334	<5	6.0	5.0	<0.1	<0.1	<0.1
01-Jul-97	4936.8	13.9	7.4	425	260	71.0	19.0	3.0	1.0	310		7.0	2.0	<0.1	<0.1	<0.1
20-Aug-97	448.8	12.0	7.8	423	250	72.0	21.0	3.0	<1	<10	<5	5.0	2.0	<0.1	<0.1	<0.1
10-Oct-97	3927.0	7.0	8.3	483	240	74.0	21.0	3.0	<1	318	<5	6.0	4.0	<0.1	<0.1	<0.1
25-Jun-98				235	72.0	19.0	3.0	<1	307	<5	6.0	5.0	0.30	<0.1	<0.1	
26-Sep-98				321	62.0	22.0	7.0	3.0	211	<5	78.0	<1	11.00	<0.1	<0.1	
21-May-99	1571.0	11.0	7.5	395												
15-Sep-99	1282.0	4.0	8.2	380	290	73.5	21.9	2.9	1.1	320	7	11.0	<1	0.2	<0.02	0.03
04-Nov-99	3.5 ft	10.0	8.4	380	270	57.2	23.0	2.6	0.9	299	<1	12.0	6.0	0.12	<0.02	<0.01
21-Jun-00	1250	8	8.49	466	281	70	19	2	<1	318	<5	5	1	0.1	<0.1	<0.1
13-Sep-00	634	13.8	8.01	390	238	60	20	3	<1	291	<5	7	2	0.1	<0.1	<0.1
17-Jun-01	1184	14.4	8.35	459	256	66	19	3	<1	311	<5	6	1	0.1	<0.1	<0.1

Springs
SP1-33

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Fe(T) mg/l	Mn(d) mg/l	Mn(T) mg/l
09-Sep-01	6.38	15.9	8.21	378													
28-Oct-01	9.02	12.3	8.29	443													
SP2-24																	
10-Oct-91	0.4	6.0	8.3	500	227	65.1	13.6	2.1	0.0	248	<1	5.0	10.0	0.06			
18-Jun-92	2.0	5.4	7.7	265	186	63.0	6.0	1.0	0.0	190	0	5.0	20.0	0.02	0.06		
29-Sep-92	0.5	7.8	7.9	300	208	94.5	20.4	0.5	0.0	204	0	80.0	20.0	0.00	0.10		
03-Jun-93	8.0	2.0	8.0	200	184	37.9	86.0	0.3	3.7	272	0	4.0	3.1	0.29	<0.05	<0.03	
01-Jul-93	7.8	12.0	7.8	200	186	41.1	9.9	1.4	6.7	158	0	4.0	3.6	<0.05	0.17	<0.03	
25-Oct-93	1.5	6.0	7.8	290	219	48.0	15.0	1.0	3.0	179	<1	5.0	7.0	<0.2	<0.2	<0.1	
02-Jun-94	5.0	42.8	8.2	280	214	40.3	9.9	1.2	8.5	168	5	<10	7.0	0.10	<0.1		
12-Sep-94	3.0	41.0	7.5	402	184	52.0	15.0	1.3	5.5	195	0	7.3	7.8	<0.05	<0.05	<0.02	
09-Sep-95	dry																
25-Jun-96																	
12-Aug-96	1.0	10.0	7.9	380	217	50.0	16.0	2.0	1.0	207	13	10.0	4.0	<0.1	<0.1	<0.1	
13-Oct-96	1.0	4.0	8.5	840	216	62.0	14.0	3.0	1.0	254	<5	11.0	3.0	<0.1	<0.1	<0.1	
07-Aug-97	dry																
09-Oct-97	dry																
15-Sep-99	2.0	13.0	8.4	300	220	43.8	15.0	2.0	0.7	197	<1	10.0	6.0	1.7	<0.02	0.04	
04-Nov-99	dry																
22-Jun-00	2.05	4.5	8.07	331	304	49	13	<1	<1	212	<5	3	2	<0.1	<0.1	<0.1	
12-Sep-00	0.233	8.4	8.13	320	190	44	14	2	<1	211	<5	3	1	0.5	<0.1	<0.1	
23-Jun-01	2.52	4.4	7.55	379	207	50	17	3	2	225	<5	6	4.5	0.1	<0.1	<0.1	
08-Sep-01	2.09	4.5	7.99	347	252	50	14	2	5	217	<5	6	5.1	<0.1	<0.05	<0.05	
27-Oct-01	1.13	5.4	7.04	349	192	50	15	2	5	204	<5	5.1	4.6	<0.1	<0.05	<0.05	
SP-47a																	
14-Jun-91	2.0	5.0	7.5	400		47.7	16.4	5.2	0.7	212	0	21.4	3.1	0.08	<0.01		
28-Jun-91						54.5	14.6	4.3	3.0	208	<1	17.0	10.0		<0.02		
21-Jul-91	0.0	6.4	4.2	400	214												
24-Aug-91	0.2	8.0	7.2	400		231	60.1	18.1	4.4	2.3	235	<1	24.0	15.0	0.11	0.02	
27-Aug-91																	
21-Sep-91	0.1	8.0	7.5	400		281	54.1	9.0	5.7	0.0	190	<1	18.0	10.0	0.13	0.01	
24-Sep-91																	
18-Jun-92	<0.1	9.7	7.1	402	202	63.7	7.8	2.7	0.0	185	0	8.0	30.0	0.00	0.00		
29-Sep-92	0.1	8.9	8.0	310	224	50.3	27.1	5.3	0.0	209	0	26.0	15.0	0.26	0.09		
04-Jun-93	<1	8.1	8.0	475	302	49.0	16.8	4.3	1.1	219	0	3.0	25.9	0.28	0.08	<0.03	
01-Jul-93	1.2	10.0	7.9	140	216	47.0	14.7	5.2	<1.1	241	0	27.0	5.7	0.14	0.06	<0.03	
25-Oct-93	1.2	4.0	7.9	310	236	46.0	17.0	3.0	<2	154	<1	22.0	9.0	1.20	0.20	<0.1	
02-Jun-94	<1	4.0	7.8	380	329	68.7	19.5	5.0	1.8	313	<1	53.5	8.0	0.03	<0.1	<0.1	

SP1-24

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Mn(T) mg/l	Mn(d) mg/l
08-Sep-01	0.122	12.7	8.08	395												
27-Oct-01	0.119	7.6	7.17	399												
SP1-9																
09-Aug-95	7.0	8.2	8.2	170	43.0	6.0	3.0	<1	171	<5	6.0	4.0	<0.1	<0.1	<0.1	<0.1
07-Aug-97	3.0	5.6	7.9	171	180	46.0	13.0	2.0	1.0	193	<5	12.0	3.0	<0.1	<0.1	<0.1
04-Oct-97	3.0	1.0	7.9	328	160	53.0	13.0	3.0	2.0	179	<5	27.0	2.0	1.30	<0.1	<0.1
25-Sep-98				167	44.0	6.0	10	<1	175	<5	2.0	<1	0.80	<0.1	<0.1	<0.1
15-Sep-99	dry															
04-Nov-99																
21-Jun-00	3.39	4.2	7.76	271	181	42	12	2	<1	183	<5	11	<1	<0.1	<0.1	<0.1
11-Sep-00	0.698	5.8	7.48	324	193	45	13	2	1	201	<5	11	<1	<0.1	<0.1	<0.1
23-Jun-01	3.06	4.6	7.46	290	163	41	12	3	<1	186	<5	10	1	0.1	<0.1	<0.1
08-Sep-01	0.822	6.8	8.11	322	222	46	14	2	<1	210	<5	13	1.3	0.9	<0.1	<0.05
27-Oct-01	0.566	6.9	8.29	288	168	46	14	3	<1	207	<5	12.6	1.2	0.4	<0.1	<0.05
SP2-1																
21-Jun-96																
24-Oct-96	0.5	3.0	8.3	865	286	79.0	17.0	3.0	<1	307	<5	1.0	2.0	<0.1	<0.1	<0.1
20-Aug-97	4.0	7.0	7.6	391	230	14.0	2.0	<1	264	<5	50	4.0	<0.1	<0.1	<0.1	<0.1
10-Oct-97	65.0	8.0	8.2	507												
25-Jun-98																
08-Sep-98																
21-May-99	1.0	9.0	7.8	450	275	87.0	12.0	1.0	1.0	318	<5	2.0	<1	<0.1	<0.1	<0.1
15-Sep-99	0.4	8.0	7.4	460	310	81.8	18.2	1.5	0.4	325	<1	8.0	7.0	0.2	<0.02	0.03
04-Nov-99	1.0	11.0	8.0	392	290	71.4	18.7	1.9	0.5	290	<1	8.0	6.0	0.28	<0.02	0.01
22-Jun-00	13.6	5.1	7.84	488	311	79	19	1	<1	363	<5	2	<1	<0.1	<0.1	<0.1
13-Sep-00	1.37	6.7	7.61	529												
17-Jun-01	19.4	5	7.49	479												
09-Sep-01	1.22	6.9	7.67	481												
28-Oct-01	1.266	6.9	7.52	516												
SP2-9																
10-Oct-91	0.6	7.0	8.0	300	170	56.4	4.4	1.8	0.0	173	<1	4.0	10.0	0.16		
09-Aug-95	dry															
07-Aug-97	4.0	5.4	7.5	294	160	9.0	2.0	<1	172	<5	8.0	1.0	<0.1	<0.1	<0.1	<0.1
09-Oct-97	<0.25	2.0	7.5	295	64	44.0	9.0	2.0	2.0	197	<5	10.0	2.0	0.70	<0.1	<0.1
25-Sep-98					198	50.0	9.0	2.0	<1	192	<5	6.0	<1	0.30	<0.1	<0.1
15-Sep-99	dry															
04-Nov-99	0.5	10.0	7.1	272	180	58.8	10.3	0.8	5.8	190	<1	12.0	8.0	1.8	<0.02	0.03
21-Jun-00	5.9	3.9	7.96	277	170	45	8	<1	<1	177	<5	4	<1	0.3	<0.1	<0.1

SP-19

Date	flow gpm	T °C	pH	Cond. μSi/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Fe(t) mg/l	Mn(T) mg/l	Mn(d) mg/l
04-Apr-91	no flow																
21~Jul-91	no flow																
10-Oct-91	no flow																
23-Jun-93	dry																
01~Jul-93	dry																
25-Oct-93	dry																
02-Jun-94	dry																
12-Sep-94	dry																
10-Mar-95	dry																
16-May-95	dry																
10-Aug-95	dry																
28-Nov-95	dry																
16-Aug-96	dry																
24-Oct-96	dry																
07-Aug-97	dry																
09-Oct-97	dry																
15-Sep-99	dry																
04-Nov-99	dry																
13-Sep-00	0.053	13.4	8.16		820												
09-Dec-00	0.04	4.9	8		660												
14-Mar-01	0.055	2.5	7.7		744												
23-Jun-01	0.121	14.1	7.78		796												
10-Sep-01	0.049	13.9	7.75		769												
29-Oct-01	0.031	9.7	8.09		822												
25-Sep-88	<1	11.7	7.1		890	504	52.0	98.5	20.1	4.8	537	40	83.4	25.9	<0.05	0.02	
30-Sep-88	<1	12.5	7.0		914	512	52.0	98.5	20.0	4.8	532	18	85.3	24.9	<0.05	0.02	
31-Oct-88	<1	7.1	8.5		995	520	48.0	87.6	17.1	2.5	523	0	73.0	11.8	<0.05	<0.01	
23-Jun-89						463	50.9	85.6	16.7	1.9	444	33	120.0	15.0	0.34	<0.01	
27-Jun-90	0.1	6.3			600		476	54.0	83.6	16.9	0.5	587	<1	25.0	20.0	<0.02	<0.01
28-Jun-90																	
19-Aug-90	no flow																
26-Sep-90	no flow																
18-Jun-91	0.7	13.6	8.0		600												
19-Jun-91																	
21-Jul-91	0.1	6.4															
24-Aug-91	no flow																
21-Sep-91	no flow																

SP-36

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Fe(T) mg/l	Mn(d) mg/l	Mn(T) mg/l	
18-Jun-92	0.0	22.9	8.3	910	484	54.1	84.9	18.3	0.0	468	12	69.0	15.0	0.00	0.03			
30-Sep-92	dry																	
23-Jun-93	dry																	
01-Jul-93	dry																	
25-Oct-93	dry																	
02-Jun-94	<1	6.0	8.1	840	432	68.2	42.1	8.7	2.1	638	<1	52.4	12.5	0.10	<.01			
12-Sep-94	dry																	
10-Mar-95	dry																	
16-May-95	dry																	
09-Aug-95	dry																	
28-Nov-95	dry																	
10-Mar-96	dry																	
16-May-96	dry																	
09-Aug-96	dry																	
28-Nov-96	dry																	
07-Aug-97	dry																	
10-Jun-99	dry																	
15-Sep-99	dry																	
04-Nov-99	dry																	
13-Sep-00	0.023	16.4	7.72	664	364	60	46	8	<1	382	<5	43	7	<0.1	<0.1	<0.1	<0.1	
09-Dec-00	0.875	8.2	8.1	613	345	59	44	7	1	374	<5	46	6	<0.1	<0.1	<0.1	<0.1	
14-Mar-01	0.950	5.4	7.8	605	377	59	45	8	1	372	<5	52	7	<0.1	<0.1	<0.1	<0.1	
23-Jun-01	0.800	9.3	7.88	505	355	61	46	8	1	381	<5	48	7.3	<0.1	<0.1	<0.1	<0.1	
10-Sep-01	0.783	11.6	8.07	612	392	63	44	8	1	393	<5	54	8.3	<0.1	<0.05	<0.05	<0.05	
29-Oct-01	0.744	11.7	8.03	601	408	63	47	8	1	375	<5	50.4	7.3	<0.1	<0.05	<0.05	<0.05	
31-Jul-86	3.0	5.2	7.9	490	272	68.0	26.8	4.5	1.0	293	0	22.4	4.8	<0.05	<0.05	<0.05	<0.05	
25-Aug-86	7.0	8.9	6.8	545	264	70.0	28.0	5.0	1.1	293	0	23.5	3.8	<0.05	<0.05	<0.05	<0.05	
28-Sep-88	6.0	8.8	7.1	590	248	68.0	29.2	4.9	1.1	296	0	20.8	3.9	<0.05	<0.05	<0.05	<0.05	
31-Oct-88	6.0	5.2	8.0	597	292	68.0	26.8	3.8	1.2	294	0	28.6	3.1	<0.05	<0.05	<0.05	<0.05	
22-Jun-89						390	53.7	24.9	3.6	0.5	265	<1	28.0	15.0	0.08	0.08	0.08	
31-Aug-89						300	69.9	26.0	31.0	0.8	344	<1	68.0	5.0	0.03	0.03	0.03	
28-Sep-89						313	59.8	26.2	3.4	0.2	290	<1	20.0	10.0	<0.02	<0.02	<0.02	
31-Oct-89						266	58.1	24.8	3.4	0.9	284	<1	200.0	10.0	<0.02	<0.02	<0.02	
26-Jun-90	2.0	16.7		500	254	89.5	25.9	2.1	0.1	330	<1	50.0	15.0	<0.02	<0.02	<0.02	<0.02	
26-Jun-90						500	258	64.0	17.0	2.6	0.1	256	<1	15.0	20.0	<0.02	<0.02	<0.02
23-Jul-90	2.5	18.9																
24-Jul-90																		

SP-58

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fed ^(f) mg/l	Mn(T) mg/l	Mn(d) mg/l
19-Aug-90	6.0	8.3		400	275	75.2	20.0	9.6	0.1	303	<1	15.0	30.0	<0.02	<0.01	
27-Sep-90	5.5	8.7		400	356	79.1	22.4	7.4	0.5	321	<1	27.0	20.0	<0.02	<0.02	
26-Sep-90	60.0	4.5	7.5	500		270	58.2	25.7	3.0	290	<1	25.0	25.0	0.57	0.01	
18-Jun-91	15.0	6.0	7.6	570		289	67.9	24.8	3.7	312	<1	24.0	10.0	<0.02	0.31	
19-Jun-91	12.0	6.0	7.2	600		292	80.4	24.2	0.5	0.0	295	<1	26.0	15.0	<0.02	0.03
21-Jul-91	10.0	7.0	7.2	600		281	81.3	23.4	3.4	0.0	277	<1	28.0	20.0	0.02	<0.01
24-Sep-91	10.0	10.0	7.2	694	259	81.0	19.7	1.1	0.0	317	0	5.0	5.0	0.00	0.07	
18-Jun-92	9.7	13.3	8.0	740	275	66.8	19.1	3.7	0.0	275	0	27.0	15.0	0.00	0.00	
31-Aug-92	N/A															
04-Dec-92																
03-Jun-93	1100.0	3.0	8.5	300	240	65.4	18.6	3.6	0.1	272	0	16.0	2.7	0.31	<0.05	
01-Jul-93	62.0	9.0	8.0	340	237	56.5	15.2	3.3	1.0	242	0	21.0	3.0	0.05	0.03	
25-Oct-93	87.0	6.0	7.9	410	260	55.0	32.0	3.0	<2	265	<1	26.0	5.0	<0.2	<0.2	
09-Jun-94	15.0	41.0	7.9	450	232	60.5	22.8	3.2	1.0	306	1	28.0	<2	0.02	<0.01	
12-Sep-94	5.0	41.0	5.0	571	266	64.0	24.0	3.9	1.2	263	6	34.0	3.8	<0.05	<0.02	
16-May-95	3.8	7.0	7.8	340	280	61.0	29.0	5.0	1.0	240	20	40.0	5.0	0.30	<0.1	
10-Aug-95	125.9	9.0	8.4	368	250	58.0	22.0	5.0	<1	244	14	29.0	4.0	<0.1	<0.1	
28-Nov-95	35.8	10.0		572	300	70.0	26.0	5.0	1.0	255	15	35.0	6.0	1.00	<0.1	
25-May-97	0.5	7.0	9.0	815	434	73.0	51.9	7.1	1.8	387	<1	71.6	5.1	<0.02	<0.005	
27-Jun-97	52.0	7.4	6.7	560	380	81.0	35.0	4.0	1.0	348	<5	90.0	4.0	<0.1	<0.1	
15-Aug-97	30.0	5.0	8.0	567	350	35.0	4.0	1.0	0.0	353	<5	60.0	3.0	<0.1	<0.01	
07-Oct-97	30.0	6.0	8.0	569	350	77.0	34.0	4.0	1.0	350	<5	57.0	6.8	<0.1	<0.1	
25-Sep-98						328	71.0	28.0	4.0	1.0	307	<5	42.0	3.0	<0.1	<0.1
10-Jul-99	3.0					253	68.0	19.0	4.0	<1	270	7	17.0	<1	<0.1	<0.1
15-Sep-99	56.0	6.6	8.0	500	360	68.4	27.8	6.6	1.3	285	<1	46.0	7.0	0.04	<0.02	
04-Nov-99	4.0	11.0	8.0	499	380	81.4	39.3	3.4	1.6	380	<1	61.0	7.0	0.18	<0.01	
20-Jun-00	47.8	4.5	7.76	592	388	74	2	2	340	<5	62	2	<0.1	<0.1	<0.1	
14-Sep-00	15.4	4.8	7.94	605	349	74	33	4	2	334	<5	69	3	<0.1	<0.1	<0.1
08-Dec-00	19.4	4.7	7.6	599	391	76	34	4	1	348	<5	69	3	<0.1	<0.1	<0.1
03-May-01	23.75	4.4	7.7	610	377	79	38	3	1	350	<5	73	2	<0.1	<0.1	<0.1
07-Sep-01	20.1	5.5	7.56	592	409	77	34	4	1	353	<5	77	3.2	<0.1	<0.1	<0.1
28-Oct-01	16.5	5.6	7.77	608	376	82	36	4	2	389	<5	75.2	2.9	<0.1	<0.1	<0.05
11-Mar-01	1.0	5.4	8.3	1125		60.0	85.1	14.1	8.0	521	0	88.5	10.0	0.05	<0.01	

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Mn(T) mg/l	Mn(d) mg/l	
MW-1																
11-Mar-88	185.0	9.5	7.7	530	308	34.0	25.5	32.5	6.4	284	0	6.6	5.3	0.05	<0.01	
31-May-88	185.5	8.2	8.6	350	240	34.2	24.2	33.4	0.0	284	0	5.7	4.5	0.14	0.01	
28-Sep-88	186.7	19.0	7.1	460	240	34.0	24.3	44.0	4.7	295	0	5.1	5.3	<0.05	0.02	
03-Nov-88	10.9	10.9		460	196	32.0	17.0	39.1	4.3	282	0	5.7	3.5	<0.05	<0.01	
31-Mar-89					312	23.8	16.5	69.7	4.5	301	<1	24.0	10.0	<0.02	<0.01	
12-Jun-89					392	25.1	18.0	77.2	3.8	285	<1	50.0	20.0	0.06	<0.01	
03-Oct-89					341	15.7	13.2	78.6	3.2	311	<1	10.0	15.0	<0.02	<0.01	
18-Dec-89					292	20.6	14.5	74.0	2.1	311	<1	23.0	15.0	0.31	0.05	
18-Jan-90	10.2	8.1	450		300	31.0	17.0	65.2	0.2	314	<1	24.0	10.0	<0.02	<0.01	
29-Jan-90					279	31.2	13.7	64.1	6.4	303	<1	18.0	10.0	<0.02	<0.01	
13-Apr-90	2.0	10.3	7.8													
01-Jul-90	0.0	10.3	8.1													
24-Jul-90					307	22.4	12.2	74.4	3.5	315	<1	5.0	25.0	<0.02	0.02	
09-Oct-90					261	21.0	13.1	86.1	2.8	339	<1	15.0	10.0	<0.02	<0.01	
10-Oct-90					247	29.3	11.1	73.6	2.9	297	<1	27.0	15.0	0.13	<0.01	
20-Dec-90					247	29.3	11.1	73.6	2.9	297	<1	27.0	15.0	0.13	<0.01	
11-Jan-91																
12-Jan-91	7.7	8.2	300													
14-Jan-91					288	30.5	20.0	76.9	12.2	346	<1	21.0	14.5	0.03	0.28	
04-Apr-91	4.8	7.2	8.0	400	306	25.1	7.2	69.4	2.3	280	<1	18.0	25.0	<0.02	<0.01	
21-Jul-91					298	22.4	14.6	71.4	4.2	298	<1	14.0	15.0	0.02	<0.01	
11-Oct-91	12.0	7.8	700		289	24.2	4.6	8.6	0.0	289	<1	23.0	15.0	0.07		
10-Dec-91					265	21.8	15.1	68.8	6.8	316	0	21.0	10.0	0.00		
08-Mar-92	12.2	7.9			326	27.2	12.4	96.5	3.8	334	0	27.0	10.0	0.00		
24-Jun-92	12.2	8.0			288	26.9	9.2	84.8	5.0	287	0	28.0	15.0	0.00		
22-Sep-92	12.2	7.6			372	27.9	17.1	51.7	61.8	281	0	60.0	45.0	0.00	0.02	
08-Dec-92	13.1	7.3			252	10.9	1.4	88.0	2.1	291	0	27.0	15.0	0.08	0.00	
04-Mar-93	1.1	12.8	7.5		532	18.9	14.5	71.4	3.4	285	0	21.0	0.1	6.80	0.47	
15-Jun-93	6.0	14.6	7.3		561	333	20.2	14.9	68.3	2.4	284	0	20.0	26.3	<0.03	
16-Sep-93	1.8	11.3	7.9		568	333	19.6	18.0	90.0	4.0	283	0	17.0	28.9	<0.05	<0.03
07-Dec-93	3.0	12.4	6.7		528	353	19.0	16.0	70.0	9.0	233	<1	20.0	31.0	0.02	<0.1
02-Mar-94	0.4	56.0	6.7		554	292	27.0	10.0	78.0	4.0	284	0	15.0	19.0	0.08	<0.02

Date	flow gpm	T °C	pH	Cond. µS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	K ⁺ mg/l	Na ⁺ mg/l	HCO ₃ ⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Mn(T) mg/l	Mn(d) mg/l	
06-Jun-94	2.3	56.3	6.7	785	290	25.0	17.0	69.0	0.4	299	0	21.0	10.0	<0.05	<0.02	
28-Sep-94	0.6	58.7	6.3	920	315	18.0	14.0	80.0	16.0	291	0	19.0	26.0	0.09	<0.02	
20-Dec-94	0.5	56.2	7.0	860	300	18.0	13.0	75.0	4.0	262	0	18.0	14.0	<0.1	<0.1	
29-Mar-95					230	24.0	20.0	69.0	4.0	275	<5	17.0	12.0	<0.1	<0.1	
07-Jun-95	0.5	12.0			290	20.0	16.0	73.0	4.0	260	15	18.0	14.0	<0.1	<0.1	
27-Sep-95	0.5	15.0	7.9	540	410	110.0	43.0	14.0	5.0	475	<5	26.0	7.0	<0.1	<0.1	
18-Dec-95	0.5	15.0	7.7	705	300	21.0	16.0	69.0	4.0	295	<5	17.0	13.0	<0.1	<0.1	
26-Mar-96					268	19.0	15.0	72.0	3.8	302	<2	37.0	13.0	<0.03	<0.04	
19-Jun-96	0.5	15.4	7.7	508	296	20.0	15.0	73.0	4.0	296	<5	18.0		<0.1	<0.1	
30-Sep-96					442	85.0	47.0	15.0	6.0	460	<5	39.0	13.0	0.10	<0.1	
30-Oct-96	0.4	14.5	8.1	498	298	20.0	14.0	72.0	4.0	308	<5	18.0	13.0	<0.1	<0.1	
03-Feb-97					500	244	19.0	16.0	73.0	4.0	293	<5	18.0	12.0	0.80	<0.1
22-May-97	0.4	10.4	7.8	504	280	19.0	13.0	66.0	3.0	299	<5	18.0	12.0	0.40	<0.1	
30-Dec-97	0.4	13.2	7.5	496	290	21.0	16.0	67.0	3.0	307	<5	18.0	7.0	<0.1	<0.1	
31-Mar-98	0.1	12.6	7.7	530	279	20.0	16.0	67.0	4.0	305	<5	15.0	12.0	<0.1	<0.1	
28-May-98	0.2	12.6	7.6	518	279	21.0	15.0	76.0	4.0	300	<5	15.0	11.0	2.10	<0.1	
24-Jun-99	little flow	12.5	7.9	490	258	22.0	15.0	73.0	5.0	303	<5	17.0	12.0	<0.1	<0.1	
15-Sep-99	not enough flow															
07-Dec-99	not enough flow															
30-Mar-00	0.30	13.4	8.3	491	298	22	17	74	4	297	<5	18	12	<0.1	<0.1	
27-Jun-00	0.67	14.2	7.3	494	260	19	15	71	4	300	<5	18	11	<0.1	<0.1	
27-Sep-00	0.7	14.7	7.3	494	266	19	15	73	4	295	<5	19	13	0.4	<0.1	
14-Dec-00	0.5	13.4	8	545	285	18	14	68	4	303	<5	16	10	<0.1	<0.1	
13-Mar-01	0															
01-May-01	0															
27-Sep-01	0															
03-Dec-01	0.3	10.9	8	476	274	22	16	64	4	296	<5	15	9.4	0.7	<0.1	
															<0.05	
21-Jun-89																
02-Oct-89																
30-Jan-90																
30-Apr-90																
23-Jul-90	57.8 feet	10.0	7.8		254	118.3	47.4	18.8	7.4	448	<1	150.0	20.0	<0.02	0.1	
24-Jul-90	54.0 feet	9.6	7.9	700	492	135.5	48.9	19.9	5.4	422	<1	200.0	20.0	2	1.4	
10-Oct-90															0.1	
12-Jan-91	72.2 feet	11.4	7.5	500	592	149.9	57.8	61.0	10.5	507	<1	180.0	125.0	2.1	0.2	
14-Jan-91																

MW-2

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	F _e (d) mg/l	F _e (T) mg/l	Mn(T) mg/l	Mn(d) mg/l
21-Jun-89					57.2	74.0	48.4	24.3	6.8	349	<1	110.0	15.0	3.13	0.23		
02-Oct-89					79.7	150.0	73.6	30.7	13.5	394	<1	410.0	20.0	<0.02	0.13		
18-Mar-99	Inaccessible																
MW-4																	
04-Mar-93	dry																
15-Jun-93	dry																
16-Sep-93	dry																
17-Feb-93	dry																
02-Mar-94	dry																
06-Jun-94	dry																
28-Sep-94	dry																
20-Dec-94	dry																
29-Mar-95	dry																
27-Jun-95	dry																
27-Sep-95	dry																
18-Mar-99	Inaccessible																
MW-5																	
22-Sep-92	dry																
08-Dec-92	dry																
04-Mar-93	dry																
15-Jun-93	dry																
16-Sep-93	109 ft	12.5	7.5	104	759	850.0	356.0	18.2	9.7	411	<5	250.0	12.1	3.3	26.6	0.91	
07-Dec-93	108.8 ft	12.1	7.2	953	650	51.0	120.0	8.0	11.0	320	<1	250.0	8.0	0.14	0.30		
02-Mar-94	111.0 ft	12.3	7.1	920	653	120.0	69.0	9.2	8.0	400	<5	245.0	5.2	0.30			
06-Jun-94	111.0 ft	11.9	6.2	1063	655	34.0	114.0	9.9	20.0	394	<5	267.0	16.0	5.5	0.24		
28-Sep-94	dry																
20-Dec-94	51.5 ft	13.3	7.5	890	740	505.0	224.0	9.0	9.0	577	<5	130.0	12.0	<0.1	0.60		
18-Dec-95	108.2 ft	13.2	7.4	1132	650	108.0	58.0	7.0	5.0	520	<5	214.0	7.0	<0.1	0.10		
18-Mar-99	destroyed																
MW-6a																	
06-May-97	14.2	8.2	544	320	46.0	32.0	22.0	12.0	243	<5	61.0	17.0	0.8	<0.1	0.40		
28-May-98	12.5	7.1	524	330	63.0	36.0	13.0	5.0	310	<5	33.0	9.0	1.8	<0.1	0.20		
18-Mar-99	1.8 feet	13.1	7.7	519	317	41.0	35.0	11.0	5.0	311	<5	5.0	6.0	0.5	<0.1		
24-Jun-99	Inaccessible																
15-Sep-99	2.3 feet																
07-Dec-99	4.5 feet	12.5	8.1	526	294	62.0	39.0	15.0	4.0	343	<5	32.0	3.0	0.4	<0.1		
30-Mar-00	2 feet	12.5	7.9	526	303	53	38	13	4	340	<5	34	3	0.2	<0.1	<0.1	

Date	flow	T	pH	Cond.	TDS	Mg ²⁺	Na ⁺	K ⁺	HCO ₃ ⁻	SO ₄ ²⁻	Cl ⁻	Fe(d)	Mn(T)	Mn(d)
	gpm	°C	µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
27-Jun-00	0.8 feet	13.3	8.00	480	263	48	31	8	3	305	<5	28	4	3.6
27-Sep-00	0.8 feet	13.3	8.00	480	265	46	32	9	4	294	<5	34	5	0.6
14-Dec-00	1.5 feet	12.9	8.2	489	270	45	30	9	3	300	<5	14	2	0.6
13-Mar-01	Impacted by mining, inaccessible													
05-Jun-97	dry	14.1	7.8	547	340	64.0	37.0	17.0	6.0	317	<5	40.0	8.0	3.7
21-Aug-97	51.6 feet	14.3	7.2	507	280	60.0	35.0	13.0	4.0	308	<5	36.0	4.0	3.2
30-Dec-97	2.1 feet	12.7	6.5	504	260	53.0	35.0	13.0	4.0	306	<5	39.0	2.0	5.2
31-Mar-98	2.2 feet	13.4	7.7	52	284	57.0	34.0	12.0	5.0	327	<5	33.0	5.0	2.1
28-May-98	12.9	7.8	506	274	53.0	35.0	13.0	4.0	311	<5	29.0	4.0	2.8	<0.1
18-Mar-99	2.3 feet	13.3	7.7	512	348	52.0	35.0	13.0	4.0	309	<5	35.0	33.0	2.2
24-Jun-99	2.2 feet	11.7	7.4	511	267	64.0	38.0	13.0	3.0	328	<5	40.0	3.0	3.8
15-Sep-99	2.5 feet													
07-Dec-99	4.5 feet	13.0	7.6	524	305	53.0	37.0	13.0	4.0	332	<5	38.0	4.0	0.7
30-Mar-00	2.2 feet	13	7.5	519	310	67	42	13	4	304	<5	41	3	1.3
27-Jun-00	2.2 feet	13.6	7.1	515	275	48	33	12	4	320	<5	38	3	0.7
27-Sep-00	2.2 feet	13.6	7.1	515	257	47	33	13	4	309	<5	40	3	0.6
14-Dec-00	2.1 feet	13.3	8	518	275	46	32	12	4	312	<5	34	2	0.8
13-Mar-01	Impacted by mining, inaccessible													
05-Jun-97	13.3	12.6	6170	1390	742.0	5.0	62.0	24.0	<5	128	48.0	40.7	1.60	<0.1
22-Aug-97	3.3 feet	13.8	10.8	960	280	60.0	4.0	49.0	6.0	<5	35	27.0	8.0	0.70
30-Dec-97	0.8 feet	11.9	10.1	635	1030	69.0	6.0	48.0	7.0	<5	24	15.0	4.0	2.80
31-Mar-98	0.1 feet	13.5	11.8	468	1009	450.0	2.0	31.0	9.0	<5	56	20.0	13.0	0.60
28-May-98	12.4	11.5	461	985	304.0	1.0	29.0	9.0	<5	233	23.0	16.7	0.60	<0.1
16-Sep-98	12.9	11.8	6075	1344	397.0	<1	29.0	9.0	<5	35	12.0	2.0	0.20	<0.1
18-Mar-99	0.0 feet	13.3	12.3	6780	1404	626.0	2.0	31.0	9.0	<5	39	10.0	5.0	0.2
15-Sep-99	—	13.5	12.2	6290	1241	600.0	10.0	26.0	9.0	<5	57	11.0	8.0	0.3
07-Dec-99	0.0 feet	12.5	12.1	6640	1345	604.0	4.0	28.0	8.0	<5	86	14.0	7.0	0.3
27-Jun-00	0.0 feet	13.8	12.2	6190	1223	546	<1	25	7	<5	40	18	8	0.1
27-Sep-00	0.0 feet	13.8	12.27	6190	866	343	<1	22	6	31	<5	36	6	0.1
14-Dec-00	0.0 feet	13	12.5	4090	808	270	<1	21	6	<5	38	16	7	<0.1
13-Mar-01	Impacted by mining, inaccessible													
05-Jun-97	12.1	7.7	511	310	62.0	<0.1	4.0	2.0	319	<5	33.0	6.2	0	<0.1
21-Aug-97	0.2	11.0	6.7	496	270	63.0	33.0	5.0	2.0	314	<5	30.0	5.0	<0.1
11-Feb-98	20.1	7.4	520	3	58.0	31.0	3.0	2.0	323	<5	31.0	5.0	0	<0.1
28-May-98	0.1	10.7	6.9	514	301	60.0	34.0	5.0	2.0	312	<5	33.0	10.0	0

MW-6

Date	flow gpm	T °C	pH	Cond. μS/cm	TDS mg/l	Ca ²⁺ mg/l	Mg ²⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	CO ₃ ²⁻ mg/l	SO ₄ ²⁻ mg/l	Cl ⁻ mg/l	Fe(d) mg/l	Mn(T) mg/l	Mn(d) mg/l
16-Sep-98	0.1	11.2	7.3	577	35	61.0	32.0	4.0	2.0	324	<5	33.0	4.0	0	<0.1	<0.1
25-May-99	0.1	10.9	8.0	578	323	61.0	32.0	4.0	2.0	327	<5	29.0	4.0	<0.1	<0.1	<0.1
07-Dec-99	0.1	10.5	7.0	517	281	61.0	32.0	4.0	3.0	313	<5	34	4	1.3	<0.1	<0.1
30-Mar-00	0.11	10.5	7.5	503	200	63	35	4	2	321	<5	32	3	0.2	<0.1	<0.1
27-Jun-00	0.12	11	7.6	500	263	58	32	4	2	313	<5	34	4	3.1	<0.1	<0.1
27-Sep-00	0.1	11	7.6	500	283	57	32	5	2	316	<5	29	3	0.2	<0.1	<0.1
14-Dec-00	0.1	11.1	7.8	512	288	56	30	4	2	314	<5	32	3	0.2	<0.1	<0.1
13-Mar-01					323	56	32	4	2	313	<5	32	3	0.3	<0.1	<0.1
01-May-01	0.1	11.6	7.6	499	275	58	32	3	2	316	<5	26.1	5	0.1	<0.1	<0.1
27-Sep-01	12.2	7.8	487	314	56	32	5	2	306	<5	28	3	0.2	<0.1	<0.05	<0.05
03-Dec-01	0.1	10.5	7.5	494	282	57	32	5	2	306	<5	28	3	0.2	<0.1	<0.05

Table 3 GENWAL UPDES Chemistry and discharge

Genwal Mine Discharge 002: Chemistry for report.xls 31 Mar 2001

	Date	Monitored	Flow (gpm)	T (°C)	pH (S.U.)	Cond (us/cm)	TDS (mg/l)	TSS (mg/l)	Fe(d) (mg/l)	Fe(T) (mg/l)	Set Sol (mg/l)	DO (mg/l)	O&G (mg/l)
Mine discharge (UPDES 002)													
01-Jan-96	yes	101			8.14	624	367	<5		0.3	<0.1		<2
01-Feb-96	yes	92			8.23	650	361	10					<2
01-Mar-96	yes	66	12.3	7.46	657	432	<5		0.5	0.02			5
01-Apr-96	yes	69		7.81		370	14		0.5	0.05			7
01-May-96	yes	66		8.33	633	380	<5			0.03	0.03		4
01-Jun-96	yes	176	14.8	7.62	622	433	<5			0.02			4
01-Jul-96	yes	397	12.2	7.3	2410	216	<5			<0.1			
01-Aug-96	yes	342		8.45									
01-Sep-96	yes	322		7.43	712	439	<5		<0.1	<0.1			<2
01-Oct-96	yes	269		7.4		422	<5			<0.1			
01-Nov-96	yes	206		7.6		422	10				2		
01-Dec-96	yes	333		7.7		457	8			0.2			
01-Jan-97	yes	396	11.6	7.5		816	460	<5		<0.1	0.2		<2
01-Feb-97	yes	316	12.1	7.7		808	490	<5		<0.1	0.2		<2
01-Mar-97	yes	325	12.5	7.8		779	460	<5		<0.1	0.2		<2
01-Apr-97	yes	254	11.7	7.6		773	470	<5		<0.1	0.3		
01-May-97	yes	240	12.3	7.4		855	480	<5		<0.1	0.2		<2
01-Jun-97	yes	238	12.2	6.7		726	490	<5		<0.1	0.2		<2
01-Jul-97	yes	278	13	6.7		731	470	<5		<0.1	0.2		
01-Aug-97	yes	198	12.4	6.75		728	470	<5		<0.1	0.2		
01-Sep-97	yes	269	13.3	6.8		728	490	<5		<0.1	0.2		
01-Oct-97	yes	378	11.6	7		721	440	<5		<0.1	0.3		
01-Nov-97	yes	404											
01-Dec-97	yes	397	11.8	6.6		741	450	<5		<0.1	0.2		
01-Jan-98	yes	384	13.3	7		740	450	<5		<0.1	0.2		
01-Feb-98	yes	349	11.7	7.65		762	460	4		<0.1	0.1		
01-Mar-98	yes	326	10.4	7.05		783	472	<5		<0.1	0.2		
01-Apr-98	yes	316	12.1	7.7		795	433	4		<0.1	0.2		
01-May-98	yes	527	12.3	7.4		855	480	<5		<0.1	0.2		<2

Date	Monitored	Flow (gpm)	T (°C)	pH (S.U.)	Cond (µs/cm)	TDS (mg/l)	TSS (mg/l)	Fe(d) (mg/l)	Fe(T) (mg/l)	Set Sol (mg/l)	DO (mg/l)	O&G (mg/l)
01-Jun-98	yes	615	13.5	7.6	726	477	8	<0.1	0.2			
01-Jul-98	yes	688	13.4	7.85	666	427	<5	<0.1	<0.1			
01-Aug-98	yes	637										<2
01-Sep-98	yes	665	13.2	7.55	690	467	<5	<0.1	<0.1			
01-Oct-98	yes	689	12.2	7.1	653	449	23	<0.1	0.3			
01-Nov-98	yes	598	11.6	7.8	646	420	<5	<0.1	<0.1			<2
01-Dec-98	yes	578	10.9	7.7	660	411	<5	<0.1	<0.1			
01-Jan-99	yes	569	10.1	7.6	640	400	<5	<0.1	<0.1			<2
01-Feb-99	yes	607	10.4	7.4	722	445	<5	<0.1	<0.1			
01-Mar-99	yes	580	11.2	7.6	639	418	<5	<0.1	<0.1			
01-Apr-99	yes	565	11.2	7.7	664	335	<5	<0.1	<0.1			4.1
01-May-99	yes	556	9	7.8	667	384	<5	<0.1	<0.1			
01-Jun-99	yes	622	12.8	7.8	685	397	<5	<0.1	<0.1			
01-Jul-99	yes	214	14.4	7.42	699	427	<5	<0.1	0.3			
01-Aug-99	yes	220	14.3	7.3	721	430	<5	<0.1	<0.1			
01-Sep-99	yes	208	11.9	7.4	730	428	<5	<0.1	<0.1			
01-Oct-99	yes	357	12.3	7.8	734	448	<5	<0.1	<0.1			
01-Nov-99	yes	875	11.4	7.8	692	413	<5	<0.1	<0.1			
01-Dec-99	yes	839	12.3	6.8	684	412	<5	<0.1	<0.1			10.4
24-Jan-00	yes	760	11.5	8.0	666	405	<5	<0.1	<0.1			5.7
14-Feb-00	yes	654	11.5	7.8	675	402	<5	<0.1	0.1			4.1
30-Mar-00	yes	665	11.5	7.4	681	395	<5	<0.1	<0.1			
25-Apr-00	yes	703	11.7	8.2	704	431	<5	<0.1	<0.1			
30-May-00	yes	655	13.3	8.1	714	456	6	<0.1	<0.1			
27-Jun-00	yes	772	11.9	7.1	715	420	<5	<0.1	<0.1			
31-Jul-00	yes	766	16.6	7.7	731	457	<5	<0.1	<0.1			
29-Aug-00	yes	687	16.9	6.9	724	443	<5	<0.1	0.2			
27-Sep-00	yes	623	11.9	7.1	715	407	<5	<0.1	<0.1			
25-Oct-00	yes	705	12.8	7.7	676	413	6	<0.1	<0.1			10.2
27-Nov-00	yes	675	12.1	7.5	675	401	<5	<0.1	<0.1			9.1
07-Dec-00	yes	754	12.1	7.3	691	442	<5	<0.1	<0.1			
25-Jan-01	yes	1040	7.4	7.4	698	402	<5	<0.1	<0.1			4
15-Feb-01	yes	1050	7.8	7.8	709	412	<5	<0.1	<0.1			
13-Mar-01	yes		11.7	7.1	708	454	<5	<0.1	<0.1			<2

Date	Monitored	Flow (gpm)	T (°C)	pH (S.U.)	Cond (µs/cm)	TDS (mg/l)	TSS (mg/l)	Fe(d) (mg/l)	Fe(T) (mg/l)	Set Sol (mg/l)	DO (mg/l)	O&G (mg/l)
27-Apr-01	yes	1050	9.6	7.8	707	419	<5	<0.1	<0.1	6.8	<2	
30-May-01	yes	1040	13.2	7.6	686	412	<5	<0.1	<0.1	6.1	<2	
19-Jun-01	yes	1040	14.4	7.1	720	449	<5	<0.1	<0.1	10.6	<2	
19-Jul-01	yes	1040	14.1	6.9	730	499	<5	<0.1	<0.1	8.8	<2	
23-Aug-01	yes	1040	14.9	7.1	708	478	<5	<0.1	<0.1	8	<2	
27-Sep-01	yes	1040	12.3	7.4	685	456	<5	<0.1	<0.1	8.2	<2	
25-Oct-01	yes	1030	11.5	7.1	681	438	<5	<0.1	<0.1	9.3		
27-Nov-01	yes	1020	7.1	7.3	693	451	<5	<0.1	0.1	6.2		
05-Dec-01	yes	780	11.2	7.6	697	438	<5	<0.1	<0.1	4.8	<2	

Sed Pond Discharge (UPDES 001)

Jan-99 yes no discharge
 Feb-99 yes no discharge
 Mar-99 yes no discharge
 Apr-99 yes no discharge
 May-99 yes no discharge
 Jun-99 yes no discharge
 Jul-99 yes no discharge
 Aug-99 yes no discharge
 Sep-99 yes no discharge
 Oct-99 yes no discharge
 Nov-99 yes no discharge
 Dec-99 yes no discharge
 Jan-00 yes no discharge
 Feb-00 yes no discharge
 Mar-00 yes no discharge
 Apr-00 yes no discharge
 May-00 yes no discharge
 Jun-00 yes no discharge
 Jul-00 yes no discharge
 Aug-00 yes no discharge
 Sep-00 yes no discharge
 Oct-00 yes no discharge

Vegetation Monitoring

Patrick Collins of Mt. Nebo Scientific performed a quantitative evaluation of the four topsoil piles at the mine. His report is attached. The conclusion was that the vegetation cover for each stockpile was greater than the surrounding/reference areas. This should allow the removal of the silt fences for each stockpile.

He also performed a comparison of the plant community of the surface above the mine via infra red aerial photos. A report of that comparison is attached. The conclusion was that no major changes in vegetation caused by mining was observed.

He also performed an evaluation of the interim vegetation. A report of that vegetation monitoring is attached. The conclusion was that the vegetation cover for the interim areas was greater than the surrounding/reference areas.

**Plant Community Comparisons
of the
Crandall Canyon Mine Area**

**A Five-Year Comparison
Using Aerial Photography**



Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

ANDALEX RESOURCES
Crandall Canyon Mine
P.O. Box 1077
Price, Utah 84501

February 2002



**Plant Community Comparisons
of the
Crandall Canyon Mine Area**

**A Five-Year Comparison
Using Aerial Photography**

Introduction

The Crandall Canyon Mine is located in Crandall Canyon, a tributary of Huntington Canyon. This area is about 15 miles west of the town of Huntington, in Emery County, Utah. A commitment by the mine operator (Genwal) in the Mining & Reclamation Plan (MRP) stated that through an agreement with *the United States Forest Service and Genwal, land above and within the 20 degrees and of draw of all second mined workings shall be monitored by infrared aerial photography techniques every five (5) years.* The purpose of this commitment was to identify and document by macro-monitoring techniques major changes over time as a result from subsidence that can occur when mining coal underneath plant communities. This document is to comply with the above commitment and report the findings of the five-year comparison.

Methods

Infrared and color aerial photographs of the permit area were supplied to *Mt. Nebo Scientific, Inc.* in 2001 by *Andalex Resources*. The following years of photography were provided for examination: 1985, 1989, 1994, and 2000. All photographs were reviewed for adequacy of

coverage of appropriate areas, time-frame of photography, scale and quality. Based on these parameters the 1994 and 2000 infrared photographs were the years chosen to compare the major plant communities of the area.

To make comparisons of the plant communities, the coverage for analysis was based on section numbers provided by the operator. The survey descriptions based on SLB&M were:

T15S, R6E Sec. 35,
T15S, R7E, s 2/3 Sec. 31,
T16S, R7E Sec. 1,
T16S, R6, Sec. 2.

Results

A few minor differences were observed in the plant communities when comparing 1994 and 2000 aerial photographs, but most of these differences were likely related to seasonal differences, light (time-of-day) or photographic angle variations. No major changes such as community vigor, diseases, die-out, changes in community structure, or other differences caused by events like subsidence from underground mining activities were observed in the sections analyzed in Crandall Canyon Mine area.

**INTERIM VEGETATION MONITORING
AT THE
CRANDALL CANYON MINE**



Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

ANDALEX RESOURCES
P.O. Box 1077
Price, Utah 84501

November 2001

TABLE OF CONTENTS

INTRODUCTION	1
METHODS	1
RESULTS & DISCUSSION	2
COLOR PHOTOGRAPH	5
RAW DATA	Appendix

INTERIM VEGETATION MONITORING AT THE CRANDALL CANYON MINE

INTRODUCTION

Representative of the Crandall Canyon Mine have seeded some "Interim Areas" with a temporary seed mix with the goal to control erosion until it is time to re-disturb the areas for final reclamation. The Mining & Reclamation Plan (MRP) for the mine states that "*The disturbed areas within the mine plan area over which the water reports to the sediment pond and which have interim reclamation will achieve an 80% cover on the slopes. The other interim reclamation area will be seeded with enough vegetation to prevent erosion*".

Quantitative sampling was conducted on the vegetation of the Interim Areas in 2001 to determine whether or not the areas met the above commitment. Additionally, "Native Comparison Areas" had been chosen during the same sample period to compare other re-seeded areas (topsoil piles) with background conditions of the area. A report comparing these data sets called "*Vegetation for Erosion Control for the Crandall Canyon Mine*" (November 2001) has also been submitted to Andalex Resources. Living cover and total cover data of these Native Comparison Areas will also be used for comparisons in this report.

METHODS

Quantitative and qualitative data were taken on the Interim Areas and Native Comparison Areas in mid-July 2001. The Interim Areas where those two areas above and below the Portal Access

Road (see Color Photographs) at the Crandall Canyon Mine. The data were taken from transect lines and sample quadrats that had been placed randomly throughout the areas.

Cover estimates were made using ocular methods with meter square quadrats. Species composition and relative frequencies were also assessed from the quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 1993). Raw data for cover of all areas have been summarized on spreadsheets and these data sets have been included in this report. A color photograph of the Interim Areas was taken at the time of sampling and has been submitted with this report.

RESULTS & DISCUSSION

From the Crandall Canyon Mine's MRP, the Interim Areas that were sampled would be considered "*disturbed areas within the mine plan area over which the water reports to the sediment pond*". The standard for success in the MRP states that the "*....interim reclamation will achieve an 80% cover on the slopes*". This statement could be interpreted three ways. First, it could mean that the **total cover** should be at least 80%. That is, the mean of all ground cover including living, litter and rock cover should sum to be at least that 80%. Second, the statement could suggest that the **cover** (living cover or total cover) of interim vegetation should be at least 80% of background or natural conditions. Finally, it could simply mean that the **living cover** should be at least 80%.

It is doubtful that the author intended that living cover, or the third interpretation above, be the standard because it is unlikely that the total living cover of any of the native communities in the immediate mine area are that high

– even if overstory were to be added to the understory values (as will be shown in the Native Comparison values later).

Therefore, a comparison has been made for the first and

second interpretations described above. Firstly, when one compares the total cover, or the mean sum of living, litter and rock cover, the interim cover exceeds the 80% standard value (Fig. 1).

Fig. 1- Total Cover Comparisons
at the Crandall Canyon Mine - 2001

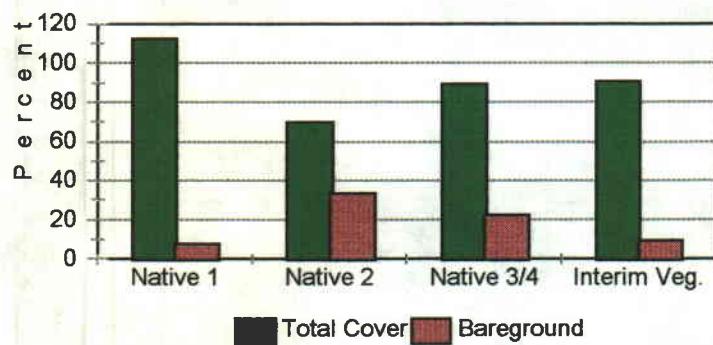
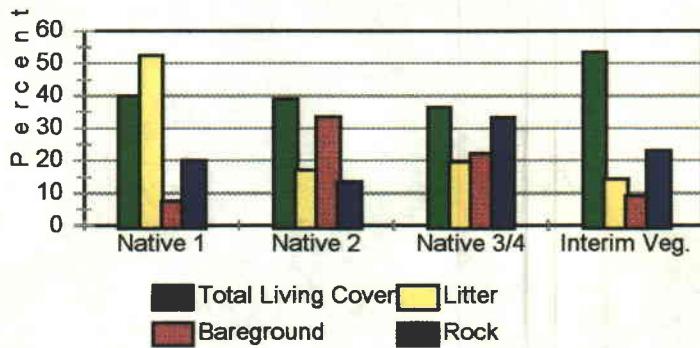


Fig. 2 - Living Cover Comparisons
at the Crandall Canyon Mine - 2001



Comparison Areas, the Interim Areas exceeded all of the Native Comparison Areas (Fig. 2).

In both of these cases, the Interim Areas meet the standard as prescribed in the MRP and is

For comparison purposes, two of the three Native Comparison Areas also exceeded this value, and two of the three had less total cover than the Interim Areas (Fig. 1). Secondly, if one compares the mean total living cover of the Interim Areas with the Native

probably controlling erosion as good as or better than the native plant communities in the mine area.

Species diversity of the Interim Areas was also relatively high. Additionally, the cover data showed that most of the species present in the Interim Area were considered "desirable" for the function of erosion control. That is, there were very few "weedy" species present in the sample quadrats – or few of those annual exotic plant species that would do little to impede erosion in the areas. A species list for the Interim Areas is shown on Fig. 3. Additional parameters for the Interim Areas and Native Comparison Areas (e.g cover by species, frequency, and lifeform composition) may be observed by referring to the APPENDIX of this report where the raw data are reported.

Fig. 3 - Species Present in the Interim Areas at the Crandall Canyon Mine 2001

<i>Agropyron cristatum</i>
<i>Artemisia dracunculus</i>
<i>Aster foliaceus</i>
<i>Aster glaucodes</i>
<i>Bromus japonicus</i>
<i>Convolvulus arvensis</i>
<i>Cynoglossum officinale</i>
<i>Elymus junceus</i>
<i>Elymus salinus</i>
<i>Elymus smithii</i>
<i>Elymus trachycaulus</i>
<i>Grindelia squarrosa</i>
<i>Linum Lewisii</i>
<i>Machaeranthera canescens</i>
<i>Penstemon eatonii</i>
<i>Rosa woodsii</i>
<i>Sambucus caerulea</i>
<i>Stipa hymenoides</i>

COLOR PHOTOGRAPH
OF THE
STUDY AREA



Interim Areas at the Crandall Canyon Mine

APPENDIX

(Raw Data)

GENWAL COAL
 Crandall Canyon Mine
 Interim Areas
 Disturbed Mountain Brush
 Exposure: S
 Slope: 30 deg.
 Sample Date: 19 July 01

#1 thru 10 are below Portal Road

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
TREES & SHRUBS							
<i>Rosa woodsii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Sambucus caerulea</i>	0.00	0.00	0.00	40.00	0.00	0.00	0.00
FORBS							
<i>Artemisia dracunculus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Aster foliaceus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Aster glaucodes</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Convolvulus arvensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Grindelia squarrosa</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Linum Lewisii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Machaeranthera canescens</i>	0.00	10.00	5.00	0.00	0.00	0.00	0.00
<i>Penstemon eatonii</i>	0.00	0.00	0.00	10.00	0.00	5.00	0.00
GRASSES							
<i>Agropyron cristatum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Bromus japonicus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus junceus</i>	60.00	55.00	45.00	35.00	25.00	35.00	30.00
<i>Elymus salinus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus smithii</i>	0.00	0.00	0.00	0.00	20.00	0.00	5.00
<i>Elymus trachycaulus</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Stipa hymenoides</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Total Living Cover	60.00	65.00	50.00	85.00	45.00	40.00	45.00
Litter	15.00	15.00	10.00	5.00	40.00	5.00	10.00
Bareground	10.00	5.00	15.00	5.00	5.00	10.00	10.00
Rock	15.00	15.00	25.00	5.00	10.00	45.00	35.00
% COMPOSITION							
Shrubs	0.00	0.00	0.00	47.06	0.00	0.00	0.00
Forbs	0.00	15.38	10.00	11.76	0.00	12.50	11.11
Grasses	100.00	84.62	90.00	41.18	100.00	87.50	88.89

#11 thru 20 are above Portal Road

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	0.00	7.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	30.00	0.00	0.00	10.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	1.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	10.00	0.00	0.00	5.00	0.00	0.00	10.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40.00	25.00	55.00	15.00	0.00	30.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	35.00	55.00	0.00	45.00	35.00	40.00	29.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55.00	35.00	60.00	60.00	65.00	65.00	50.00	40.00	55.00	45.00
20.00	10.00	10.00	15.00	20.00	15.00	20.00	10.00	25.00	10.00
5.00	5.00	5.00	5.00	5.00	10.00	15.00	30.00	5.00	10.00
20.00	50.00	25.00	20.00	10.00	10.00	15.00	20.00	15.00	35.00
0.00	0.00	0.00	0.00	10.77	0.00	0.00	0.00	0.00	0.00
9.09	0.00	8.33	16.67	4.62	53.85	10.00	12.50	27.27	24.44
90.91	100.00	91.67	83.33	84.62	46.15	90.00	87.50	72.73	75.56

GENWAL COAL
 Crandall Canyon Mine
 Interim Areas
 Disturbed Mountain Brush
 Exposure: S
 Slope: 30 deg.
 Sample Date: 19 July 01

18.00	19.00	20.00	Mean	SDev	Freq	
						TREES & SHRUBS
0.00	0.00	0.00	0.35	1.53	5.00	<i>Rosa woodsii</i>
0.00	0.00	0.00	2.00	8.72	5.00	<i>Sambucus caerulea</i>
						FORBS
0.00	0.00	0.00	0.15	0.65	5.00	<i>Artemisia dracunculus</i>
0.00	0.00	0.00	2.00	6.78	10.00	<i>Aster foliaceus</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Aster glaucodes</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Convolvulus arvensis</i>
0.00	0.00	0.00	0.55	1.50	15.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Grindelia squarrosa</i>
5.00	5.00	10.00	2.50	3.71	35.00	<i>Linum Lewisii</i>
0.00	0.00	0.00	0.75	2.38	10.00	<i>Machaeranthera canescens</i>
0.00	0.00	0.00	0.75	2.38	10.00	<i>Penstemon eatonii</i>
						GRASSES
0.00	0.00	0.00	0.25	1.09	5.00	<i>Agropyron cristatum</i>
5.00	0.00	0.00	0.25	1.09	5.00	<i>Bromus japonicus</i>
0.00	25.00	0.00	23.75	20.43	65.00	<i>Elymus junceus</i>
0.00	0.00	25.00	1.25	5.45	5.00	<i>Elymus salinus</i>
25.00	30.00	10.00	16.45	18.14	55.00	<i>Elymus smithii</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Elymus trachycaulus</i>
0.00	0.00	10.00	1.50	3.57	10.00	<i>Stipa hymenoides</i>
						COVER
35.00	60.00	55.00	53.50	11.95		Total Living Cover
10.00	10.00	10.00	14.25	7.79		Litter
15.00	5.00	10.00	9.25	5.97		Bareground
40.00	25.00	25.00	23.00	12.08		Rock
						% COMPOSITION
0.00	0.00	0.00	2.89	10.40		Shrubs
14.29	8.33	18.18	13.42	11.63		Forbs
85.71	91.67	81.82	83.69	15.04		Grasses

GENWAL COAL

Crandall Canyon Mine

Native Comparison #1

Mountain Shrub/Conifer

Exposure: S

Slope: 30 deg.

Sample Date: 18 July 01

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	25.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	15.00	0.00
<i>Pinus ponderosa</i>	0.00	0.00	20.00	5.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	35.00	0.00
UNDERSTORY							
SHRUBS							
<i>Chrysothamnus nauseosus</i>	1.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	3.00	0.00	5.00	0.00	0.00
<i>Mahonia repens</i>	1.00	10.00	2.00	5.00	5.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00
FORBS							
<i>Solidago</i> sp.	0.00	0.00	0.00	0.00	0.00	0.00	5.00
GRASSES							
<i>Elymus salinus</i>	10.00	25.00	10.00	5.00	5.00	5.00	5.00
<i>Stipa hymenoides</i>	8.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Overstory	0.00	0.00	20.00	5.00	0.00	75.00	0.00
Understory	20.00	35.00	15.00	15.00	15.00	5.00	10.00
Litter	65.00	45.00	45.00	50.00	50.00	89.00	10.00
Bareground	5.00	10.00	10.00	10.00	10.00	1.00	5.00
Rock	10.00	10.00	30.00	25.00	25.00	5.00	75.00
% COMPOSITION							
Shrubs	10.00	28.57	33.33	66.67	66.67	0.00	0.00
Forbs	0.00	0.00	0.00	0.00	0.00	0.00	50.00
Grasses	90.00	71.43	66.67	33.33	33.33	100.00	50.00
Overstory + Understory	20.00	35.00	35.00	20.00	15.00	80.00	10.00

GENWAL COAL
 Crandall Canyon Mine
 Native Comparison #1
 Mountain Shrub/Conifer
 Exposure: S
 Slope: 30 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

						OVERSTORY
0.00	0.00	0.00	2.50	7.50	10.00	<i>Juniperus scopulorum</i>
0.00	0.00	0.00	1.50	4.50	10.00	<i>Pinus edulis</i>
85.00	15.00	0.00	12.50	25.12	40.00	<i>Pinus ponderosa</i>
0.00	0.00	0.00	3.50	10.50	10.00	<i>Pseudotsuga menziesii</i>

						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	0.10	0.30	10.00	<i>Chrysothamnus nauseosus</i>
0.00	0.00	0.00	0.80	1.66	20.00	<i>Juniperus scopulorum</i>
0.00	0.00	0.00	2.30	3.20	50.00	<i>Mahonia repens</i>
0.00	0.00	5.00	0.50	1.50	10.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Symporicarpos oreophilus</i>
						FORBS
0.00	5.00	10.00	2.00	3.32	30.00	<i>Solidago sp.</i>

						GRASSES
5.00	40.00	20.00	13.00	11.22	100.00	<i>Elymus salinus</i>
0.00	0.00	0.00	0.80	2.40	10.00	<i>Stipa hymenoides</i>

						COVER
85.00	15.00	0.00	20.00	30.82		Overstory
5.00	45.00	35.00	20.00	13.04		Understory
85.00	45.00	40.00	52.40	21.65		Litter
5.00	5.00	15.00	7.60	3.85		Bareground
5.00	5.00	10.00	20.00	20.37		Rock

						% COMPOSITION
0.00	0.00	14.29	21.95	25.10		Shrubs
0.00	11.11	28.57	8.97	16.23		Forbs
100.00	88.89	57.14	69.08	24.12		Grasses
90.00	60.00	35.00	40.00	26.27	Overstory + Understory	

GENWAL COAL

Crandall Canyon Mine

Native Comparison #2

Mountain Brush Community

Exposure: S & SW

Slope: 30 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

OVERSTORY

<i>Cercocarpus ledifolius</i>	0.00	0.00	25.00	5.00	0.00	0.00	0.00
-------------------------------	------	------	-------	------	------	------	------

UNDERSTORY

SHRUBS

<i>Cercocarpus ledifolius</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00
<i>Mahonia repens</i>	0.00	0.00	0.00	0.00	10.00	10.00	0.00

FORBS

<i>Artemisia ludoviciana</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Cirsium sp.</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00

GRASSES

<i>Elymus salinus</i>	25.00	5.00	0.00	25.00	25.00	30.00	40.00
<i>Elymus spicatus</i>	0.00	10.00	30.00	0.00	0.00	0.00	0.00
<i>Stipa hymenoides</i>	0.00	10.00	0.00	0.00	0.00	0.00	0.00

COVER

Overstory	0.00	0.00	25.00	5.00	0.00	0.00	0.00
Understory	25.00	25.00	40.00	25.00	35.00	50.00	40.00
Litter	5.00	5.00	10.00	10.00	45.00	30.00	45.00
Bareground	45.00	50.00	40.00	55.00	5.00	5.00	5.00
Rock	25.00	20.00	10.00	10.00	15.00	15.00	10.00

% COMPOSITION

Shrubs	0.00	0.00	0.00	0.00	28.57	40.00	0.00
Forbs	0.00	0.00	25.00	0.00	0.00	0.00	0.00
Grasses	100.00	100.00	75.00	100.00	71.43	60.00	100.00

Overstory + Understory	25.00	25.00	65.00	30.00	35.00	50.00	40.00
------------------------	-------	-------	-------	-------	-------	-------	-------

GENWAL COAL
 Crandall Canyon Mine
 Native Comparison #2
 Mountain Brush Community
 Exposure: S & SW
 Slope: 30 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

0.00 0.00 0.00 3.00 7.48 20.00 OVERSTORY
Cercocarpus ledifolius

0.00 0.00 0.00 0.50 1.50 10.00 UNDERSTORY
 SHRUBS
Cercocarpus ledifolius
 5.00 0.00 0.00 1.00 2.00 20.00 *Juniperus scopulorum*
 0.00 0.00 0.00 2.00 4.00 20.00 *Mahonia repens*

5.00 0.00 0.00 1.00 2.00 20.00 FORBS
 0.00 0.00 0.00 0.50 1.50 10.00 *Artemisia ludoviciana*
Cirsium sp.

30.00 10.00 20.00 21.00 11.79 90.00 GRASSES
 0.00 5.00 0.00 4.50 9.07 40.00 *Elymus salinus*
 15.00 10.00 20.00 5.50 7.23 30.00 *Elymus spicatus*
Stipa hymenoides

0.00 0.00 0.00 3.00 7.48 COVER
 55.00 25.00 40.00 36.00 10.44 Overstory
 5.00 10.00 5.00 17.00 15.68 Understory
 30.00 55.00 45.00 33.50 19.88 Litter
 10.00 10.00 10.00 13.50 5.02 Bareground
 Rock

9.09 0.00 0.00 7.77 13.77 % COMPOSITION
 9.09 0.00 0.00 3.41 7.69 Shrubs
 81.82 100.00 100.00 88.82 14.57 Forbs
 Grasses

55.00 25.00 40.00 39.00 13.19 Overstory + Understory

GENWAL COAL

Crandall Canyon Mine

Native Comparison #3/4

Mountain Brush/ PJ Transition

Exposure: S SE

Slope: 25 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

OVERSTORY

<i>Juniperus scopulorum</i>	0.00	15.00	0.00	0.00	0.00	0.00	40.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00

UNDERSTORY

SHRUBS

<i>Artemesia tridentata</i>	3.00	20.00	0.00	0.00	25.00	0.00	5.00
<i>Chrysothamnus nauseosus</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Mahonia repens</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Opuntia polyacantha</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symporicarpos oreophilus</i>	0.00	10.00	0.00	0.00	0.00	0.00	0.00

FORBS

<i>Aster foliaceous</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Machaeranthera canescens</i>	2.00	0.00	2.00	0.00	0.00	0.00	0.00
<i>Penstemon</i> sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GRASSES

<i>Elymus salinus</i>	0.00	20.00	2.00	15.00	0.00	25.00	0.00
<i>Elymus spicatus</i>	0.00	0.00	0.00	0.00	15.00	0.00	5.00
<i>Poa secunda</i>	5.00	0.00	1.00	0.00	0.00	0.00	0.00
<i>Stipa hymenoides</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00

COVER

Overstory	0.00	15.00	0.00	0.00	0.00	0.00	40.00
Understory	20.00	50.00	10.00	20.00	40.00	25.00	10.00
Litter	5.00	5.00	1.00	5.00	10.00	10.00	25.00
Bareground	35.00	40.00	65.00	40.00	15.00	40.00	5.00
Rock	40.00	5.00	24.00	35.00	35.00	25.00	60.00

% COMPOSITION

Shrubs	40.00	60.00	50.00	25.00	62.50	0.00	50.00
Forbs	10.00	0.00	20.00	0.00	0.00	0.00	0.00
Grasses	50.00	40.00	30.00	75.00	37.50	100.00	50.00
Overstory + Understory	20.00	65.00	10.00	20.00	40.00	25.00	50.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	Mean	SDev
0.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	12.94
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.25
80.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.33	19.96
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.53	7.62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.25
0.00	0.00	0.00	33.00	0.00	0.00	0.00	0.00	2.20	8.23
0.00	0.00	0.00	0.00	0.00	10.00	15.00	2.00	2.13	4.36
0.00	0.00	3.00	0.00	5.00	0.00	0.00	0.00	0.53	1.41
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	1.00	2.71
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.33	1.25
0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.60	1.36
0.00	0.00	2.00	2.00	0.00	0.00	0.00	0.00	0.27	0.68
1.00	0.00	10.00	0.00	0.00	0.00	15.00	13.00	6.73	8.44
0.00	0.00	0.00	0.00	5.00	15.00	0.00	5.00	3.00	5.10
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.73	1.69
0.00	10.00	0.00	10.00	20.00	0.00	0.00	0.00	3.00	5.72
80.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	11.67	22.78
1.00	10.00	15.00	50.00	35.00	25.00	40.00	20.00	24.73	14.66
65.00	55.00	70.00	10.00	5.00	5.00	5.00	20.00	19.73	22.78
4.00	5.00	10.00	20.00	35.00	5.00	5.00	10.00	22.27	18.22
30.00	30.00	5.00	20.00	25.00	65.00	50.00	50.00	33.27	17.03
0.00	0.00	20.00	66.00	14.29	40.00	50.00	10.00	32.52	23.14
0.00	0.00	13.33	14.00	14.29	0.00	0.00	0.00	4.77	7.00
100.00	100.00	66.67	20.00	71.43	60.00	50.00	90.00	62.71	25.42
81.00	50.00	15.00	50.00	35.00	25.00	40.00	20.00	36.40	19.34

GENWAL COAL
Crandall Canyon Mine
Native Comparison #3/4
Mountain Brush/ PJ Transition
Exposure: S SE
Slope: 25 deg.
Freq Sample Date: 18 July 01

OVERSTORY

20.00	<i>Juniperus scopulorum</i>
6.67	<i>Pinus edulis</i>
6.67	<i>Pseudotsuga menziesii</i>

UNDERSTORY

SHRUBS

26.67	<i>Artemisia tridentata</i>
6.67	<i>Chrysothamnus nauseosus</i>
6.67	<i>Gutierrezia sarothrae</i>
6.67	<i>Juniperus scopulorum</i>
26.67	<i>Mahonia repens</i>
13.33	<i>Opuntia polyacantha</i>
13.33	<i>Symporicarpos oreophilus</i>

FORBS

6.67	<i>Aster foliaceous</i>
20.00	<i>Machaeranthera canescens</i>
13.33	<i>Penstemon sp.</i>

GRASSES

53.33	<i>Elymus salinus</i>
33.33	<i>Elymus spicatus</i>
20.00	<i>Poa secunda</i>
26.67	<i>Stipa hymenoides</i>

COVER

Overstory
Understory
Litter
Bareground
Rock

% COMPOSITION

Shrubs
Forbs
Grasses

Overstory + Understory

**VEGETATION MONITORING
FOR
EROSION CONTROL**

**FOR THE
CRANDALL CANYON MINE**



Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

ANDALEX RESOURCES
P.O. Box 1077
Price, Utah 84501

November 2001

TABLE OF CONTENTS

INTRODUCTION	1
METHODS	2
RESULTS	3
Topsoil Pile #1	3
Topsoil Pile #2	4
Topsoil Pile #3	5
Topsoil Pile #4	6
DISCUSSION & RECOMMENDATIONS	7
COLOR PHOTOGRAPHS	9-13
RAW DATA	Appendix

VEGETATION MONITORING FOR EROSION CONTROL

INTRODUCTION

Crandall Canyon is a tributary of Huntington Canyon and is located about 15 miles west of the town of Huntington, in Emery County, Utah. The Crandall Canyon Mine has preserved topsoil from areas that had been previously disturbed by mine-related activities. These piles had been seeded previously with a temporary seed mix that was required to stabilize the piles and protect them from wind and water erosion. During the time it takes for this new vegetation to become established, erosion control structures such as silt fences and straw bales were installed near the piles to prevent sediments from entering nearby streams and drainages. These erosion control structures were intended to be temporary and remain until the vegetation could control erosion more naturally, or at least as well as background conditions.

The goal of this study was to test the effectiveness of the plant cover on the topsoil piles for its capacity for controlling erosion. To do this we took quantitative cover measurements of the piles and also from the native undisturbed plant communities adjacent to them. We used the native communities as success standards to test the hypothesis that the topsoil cover was equal to or greater than the adjacent undisturbed communities. If the living cover of the piles was at least as high as the native cover, we could make the assumption that the erosion controlled by the cover of the piles was as good as background conditions and *artificial erosion control structures would no longer be necessary.*

METHODS

Quantitative and qualitative data were taken on the topsoil piles and 'Native Comparison Areas' in Crandall Canyon in mid-July 2001. Native Comparison Areas were chosen near each topsoil pile to represent the background conditions. Because Topsoil Piles 3 and 4 were so close in proximity to each other and were placed in transitional plant communities (or transitional zones between two or more plant communities that exhibit likenesses for both communities), one Native Comparison Area was chosen to represent both piles. The comparison area was also in a transitional zone. The data were taken from transect lines and sample quadrats that had been placed randomly throughout the Topsoil Piles and the Native Comparison areas adjacent to them.

Cover estimates were made using ocular methods with meter square quadrats. Species composition and relative frequencies were also assessed from the quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 1993). Raw data for cover have been summarized on a spreadsheet and are included in this report.

Color photographs of the sample areas were taken at the time of sampling and have been submitted with this report. For exact locations of the numbered topsoil piles, refer to pertinent maps in Crandall Canyon Mine, Mining and Reclamation Plan (MRP).

RESULTS

A summary for the quantitative sampling for total living cover for each Topsoil Pile and Native Comparison Area is given below. The summary concentrates on 'total' living cover, rather than other parameters that can also be derived from the samples such as cover by species and lifeform composition. However, these parameters may be examined by reviewing the RAW DATA provided in the APPENDIX of this report. Color photographs of each study area have been included in this report (see "COLOR PHOTOGRAPHS").

Topsoil Pile #1

Total living cover for Topsoil Pile #1 was estimated at 64.50%. The sample quadrats placed on the pile encountered only grass species. The dominant plant species for this pile

**FIG. 1: CRANDALL CANYON MINE
TOPSOIL PILE #1**

<u>Species Present in Sample Quadrats</u>
<i>Agropyron cristatum</i>
<i>Bromus carinatus</i>
<i>Elymus trachycaulus</i>
<i>Elymus smithii</i>

was crested wheatgrass (*Agropyron cristatum*). Figure 1

shows the species that were encountered in the sample quadrats for Topsoil Pile #1.

**FIG. 2: CRANDALL CANYON MINE
NATIVE COMPARISON #1**

<u>Species Present in Sample Quadrats</u>
<i>Chrysothamnus nauseosus</i>
<i>Elymus salinus</i>
<i>Juniperus scopulorum</i>
<i>Mahonia repens</i>
<i>Pinus edulis</i>
<i>Pinus ponderosa</i>
<i>Pseudotsuga menziesii</i>
<i>Solidago sp.</i>
<i>Stipa hymenoides</i>
<i>Symphoricarpos oreophilus</i>

The Native Comparison Area #1 for this topsoil pile was chosen in a Mountain Brush (with some conifer stands) plant community. Total living cover (overstory plus understory cover) for this community was estimated at 40.00%. The

dominant species in this area was also a grass, or Salina wildrye (*Elymus salinus*). The next most important cover measurement was from overstory cover provided by ponderosa pine (*Pinus ponderosa*). Figure 2 provides a list of species from sampling this area.

Topsoil Pile #2

Topsoil Pile #2 was comprised of 63.50% living cover. With the exception of the presence of one shrub, Wood's rose (*Rosa woodsii*), grasses dominated this pile. The dominant grass species was mountain brome (*Bromus carinatus*). See Figure 3 for a list of species present in these quadrats.

FIG. 3: CRANDALL CANYON MINE TOPSOIL PILE #2	
<u>Species Present in Sample Quadrats</u>	
Agropyron cristatum	
Bromus carinatus	
Elymus smithii	
Elymus trachycaulus	
Rosa woodsii	

The Native Comparison Area #2, a Mountain Brush community, for this topsoil pile had a total living cover of 39.00%. Grasses also dominated this

community and the most important species by cover and frequency was Salina wildrye. Fig. 4 lists the species found in the sample quadrats.

FIG. 4: CRANDALL CANYON MINE NATIVE COMPARISON #2	
<u>Species Present in Sample Quadrats</u>	
Artemisia ludoviciana	
Cercocarpus ledifolius	
Cirsium sp.	
Elymus salinus	
Elymus spicatus	
Juniperus scopulorum	
Mahonia repens	
Stipa hymenoides	

Topsoil Pile #3

Topsoil Pile #3 had a total living cover of 59.50%. Like the previously described topsoil piles,

grasses dominated this pile, but several shrub and forb species were also present (see Fig. 5). The dominant grass species for this topsoil pile was Russian wildrye (*Elymus junceus*), the dominant shrub was big sagebrush (*Artemisia tridentata*), and the dominant forb was blueleaf aster (*Aster glaucodes*).

**FIG. 5: CRANDALL CANYON MINE
TOPSOIL PILE #3**

Species Present in Sample Quadrats

Agropyron cristatum
Artemisia tridentata
Aster glaucodes
Cirsium sp.
Cynoglossum officinale
Elymus junceus
Elymus smithii
Elymus trachycaulus
Juniperus scopulorum
Poa secunda
Symphoricarpos oreophilus

The Native Comparison Area 3/4 chosen to be compared with this pile was a Mountain Brush (with some Pinyon-Juniper) community. This community had a total living cover of 36.40%. Like the aforementioned native plant communities, the dominant species was the grass, Salina wildrye, but was followed closely by tree canopy or overstory cover. The dominant tree was Rocky Mountain Juniper (*Juniperus scopulorum*). For a list of species of the Native Comparison Area 3/4 (Topsoil Piles 3 and 4 used the same Native Comparison Area), refer to Fig. 6.

**FIG. 6: CRANDALL CANYON MINE
NATIVE COMPARISON #3/4**

Species Present in Sample Quadrats

Artemisia tridentata
Aster foliaceous
Chrysanthemus nauseosus
Elymus salinus
Elymus spicatus
Gutierrezia sarothrae
Juniperus scopulorum
Machaeranthera canescens
Mahonia repens
Opuntia polyacantha
Penstemon sp.
Pinus edulis
Poa secunda
Pseudotsuga menziesii
Stipa hymenoides
Symphoricarpos oreophilus

Topsoil Pile #4

The total living cover for Topsoil Pile #4 was estimated at 55.50%. The dominant plant species for this pile was bluebunch wheatgrass (*Elymus spicatus*). This pile had the greatest species diversity when compared to the other topsoil piles and was well-represented by three lifeforms: grasses, forbs and shrubs. See Fig. 7 for a list of species present in the sample quadrats.

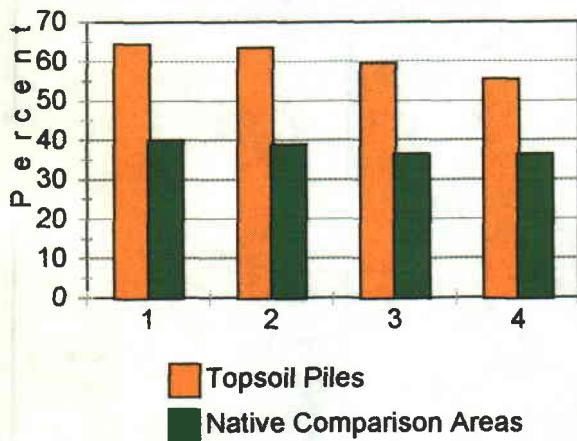
The Native Comparison Area for Topsoil Pile #4 was the same area used for Topsoil Pile #3 and it had a total living cover of 36.40%. For a list of species, refer again to Fig. 6.

FIG. 7: CRANDALL CANYON MINE TOPSOIL PILE #4	
<u>Species Present in Sample Quadrats</u>	
	<i>Achillea millefolium</i>
	<i>Agropyron cristatum</i>
	<i>Bromus carinatus</i>
	<i>Cynoglossum officinale</i>
	<i>Dactylis glomeratus</i>
	<i>Elymus cinereus</i>
	<i>Elymus smithii</i>
	<i>Elymus spicatus</i>
	<i>Linum lewisii</i>
	<i>Medicago sativa</i>
	<i>Penstemon</i> sp.
	<i>Ribes aureum</i>
	<i>Rosa woodsii</i>
	<i>Symporicarpos oreophilus</i>

DISCUSSION & RECOMMENDATIONS

A graphic comparison showing the cover of all four Topsoil Piles and their respective Native Comparison Areas is illustrated on Figure 8. Additionally, statistical analyses comparing the Topsoil Piles with the Native Comparison Areas are shown on Table 1. The mean total cover for all the re-seeded Topsoil Piles exceeded the Native Comparison Areas by a statistically significant margin. Additionally, the cover data showed that the species present in the Topsoil Piles were all considered "desirable" for the function of erosion control. Furthermore, there were very few "weedy" species present in the sample quadrats – or few of those annual exotics plant species that would do little to impede erosion in the areas.

FIG. 8: LIVING COVER COMPARISONS
Crandall Canyon Mine



Because living plant cover significantly exceeded that of background or natural undisturbed conditions in the area, it is therefore recommended that the temporary erosion control structures on the Topsoil Piles at the Crandall Canyon Mine be removed.

**Table 1: Statistical Comparisons for the
Topsoil Piles & Native Comparison Areas
at the Crandall Canyon Mine**

Topsoil Pile No.	\bar{x}	s	n	Native Comparison Area	\bar{x}	s	n	t-value
1	64.50	4.15	10	1	40.00	26.27	10	2.913*
2	63.50	8.96	10	2	39.00	13.19	10	4.859*
3	59.50	9.34	10	3/4	36.40	19.34	15	3.497*
4	55.50	9.07	10	3/4	36.40	19.34	15	2.902*

\bar{x} = mean % cover

s = standard deviation

n = sample size

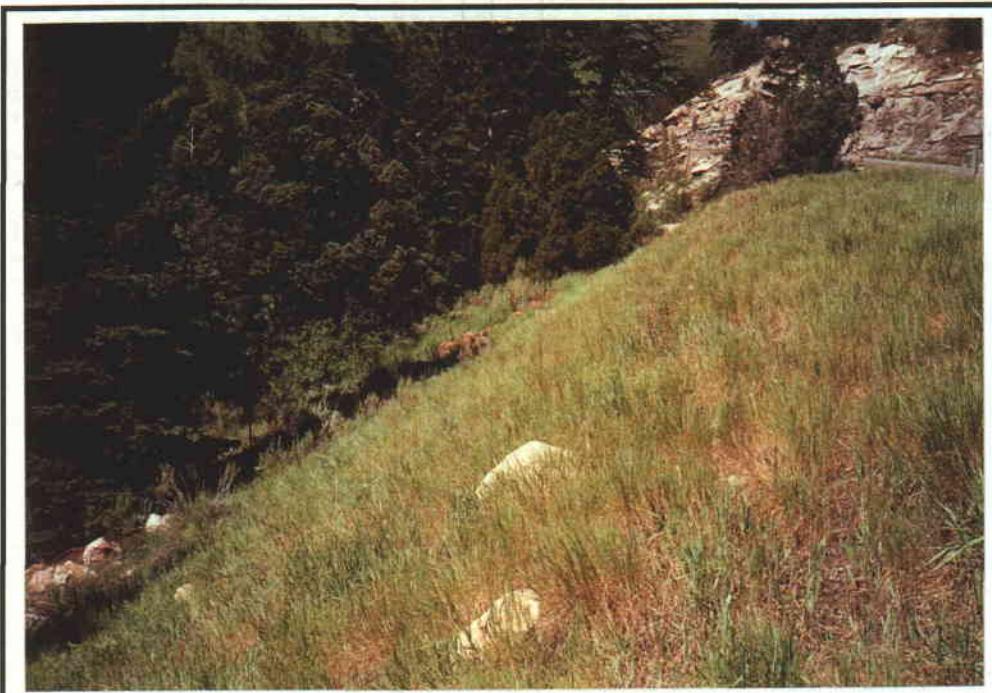
t = Student's t-value

* = significant: $p < .005$

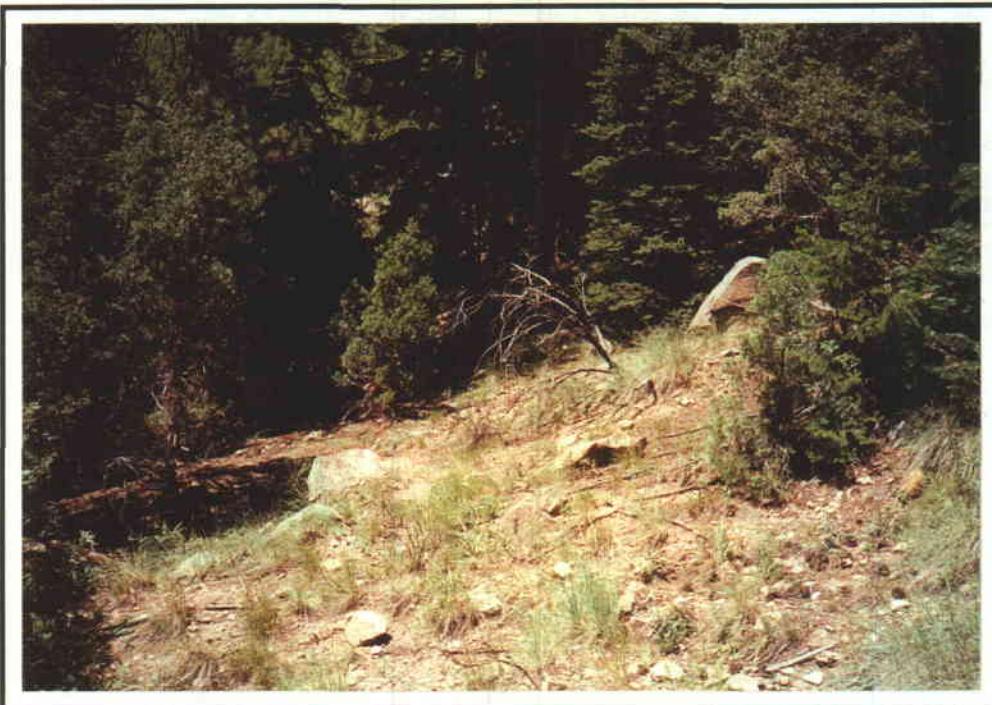
COLOR PHOTOGRAPHS

of the
Sample Areas

Topsoil Pile #1



Native Comparison Area #1



Topsoil Pile #2



Native Comparison Area #2



Topsoil Pile #3



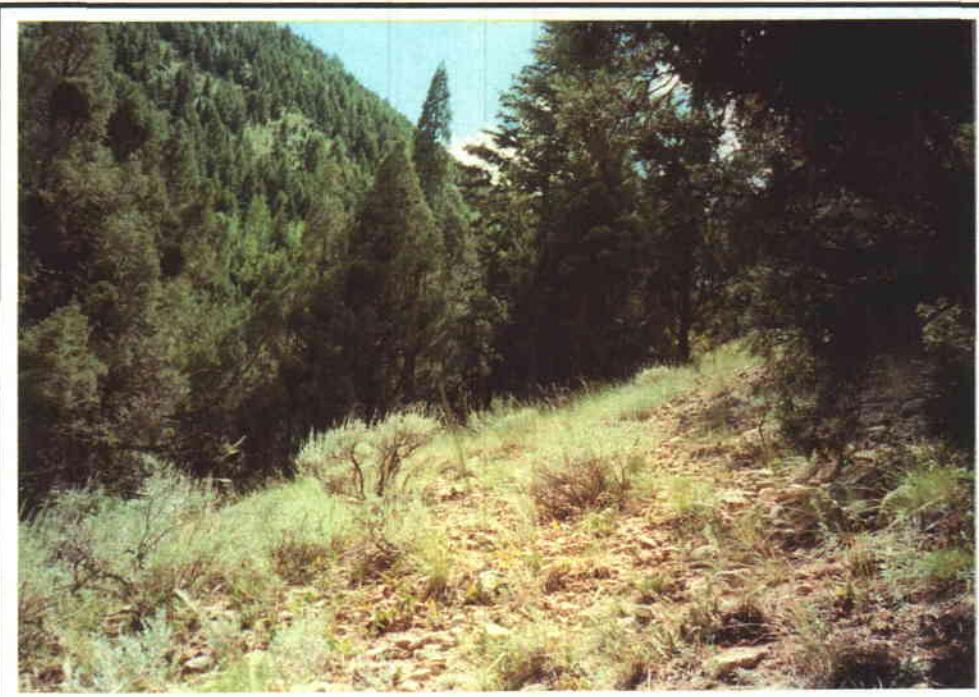
Native Comparison Area #3/4



Topsoil Pile #4



Native Comparison Area #3/4



APPENDIX

Raw Data

GENWAL COAL

Crandall Canyon Mine

Topsoil Pile #1

Exposure: S

Slope: 1 - 28 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

TREES & SHRUBS

FORBS

GRASSES

<i>Agropyron cristatum</i>	30.00	10.00	70.00	10.00	40.00	25.00	55.00
<i>Bromus carinatus</i>	15.00	35.00	0.00	20.00	15.00	25.00	10.00
<i>Elymus trachycaulus</i>	20.00	10.00	0.00	10.00	5.00	15.00	0.00
<i>Elymus smithii</i>	0.00	10.00	0.00	20.00	5.00	5.00	0.00

COVER

Total Living Cover	65.00	65.00	70.00	60.00	65.00	70.00	65.00
Litter	20.00	30.00	20.00	20.00	25.00	20.00	15.00
Bareground	5.00	1.00	9.00	5.00	9.00	5.00	15.00
Rock	10.00	4.00	1.00	15.00	1.00	5.00	5.00

% COMPOSITION

Shrubs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forbs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grasses	100.00	100.00	100.00	100.00	100.00	100.00	100.00

GENWAL COAL
Crandall Canyon Mine
Topsoil Pile #1
Exposure: S
Slope: 1 - 28 deg.
Sample Date: 18 July 01

8.00 9.00 10.00 Mean SDev Freq

TREES & SHRUBS

FORBS

GRASSES					
50.00	30.00	20.00	34.00	18.68	100.00
10.00	10.00	40.00	18.00	11.66	90.00
0.00	5.00	5.00	7.00	6.40	70.00
5.00	10.00	0.00	5.50	6.10	60.00
<i>Agropyron cristatum</i>					
<i>Bromus carinatus</i>					
<i>Elymus trachycaulus</i>					
<i>Elymus smithii</i>					

COVER					
65.00	55.00	65.00	64.50	4.15	Total Living Cover
25.00	30.00	25.00	23.00	4.58	Litter
5.00	5.00	9.00	6.80	3.63	Bareground
5.00	10.00	1.00	5.70	4.41	Rock

% COMPOSITION					
0.00	0.00	0.00	0.00	0.00	Shrubs
0.00	0.00	0.00	0.00	0.00	Forbs
100.00	100.00	100.00	100.00	0.00	Grasses

GENWAL COAL

Crandall Canyon Mine

Native Comparison #1

Mountain Shrub/Conifer

Exposure: S

Slope: 30 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

OVERSTORY

<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	25.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	15.00	0.00
<i>Pinus ponderosa</i>	0.00	0.00	20.00	5.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	35.00	0.00

UNDERSTORY

SHRUBS

<i>Chrysothamnus nauseosus</i>	1.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	3.00	0.00	5.00	0.00	0.00
<i>Mahonia repens</i>	1.00	10.00	2.00	5.00	5.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00

FORBS

<i>Solidago sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
---------------------	------	------	------	------	------	------	------

GRASSES

<i>Elymus salinus</i>	10.00	25.00	10.00	5.00	5.00	5.00	5.00
<i>Stipa hymenoides</i>	8.00	0.00	0.00	0.00	0.00	0.00	0.00

COVER

Overstory	0.00	0.00	20.00	5.00	0.00	75.00	0.00
Understory	20.00	35.00	15.00	15.00	15.00	5.00	10.00
Litter	65.00	45.00	45.00	50.00	50.00	89.00	10.00
Bareground	5.00	10.00	10.00	10.00	10.00	1.00	5.00
Rock	10.00	10.00	30.00	25.00	25.00	5.00	75.00

% COMPOSITION

Shrubs	10.00	28.57	33.33	66.67	66.67	0.00	0.00
Forbs	0.00	0.00	0.00	0.00	0.00	0.00	50.00
Grasses	90.00	71.43	66.67	33.33	33.33	100.00	50.00
Overstory + Understory	20.00	35.00	35.00	20.00	15.00	80.00	10.00

GENWAL COAL
 Crandall Canyon Mine
 Native Comparison #1
 Mountain Shrub/Conifer
 Exposure: S
 Slope: 30 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

						OVERSTORY
0.00	0.00	0.00	2.50	7.50	10.00	<i>Juniperus scopulorum</i>
0.00	0.00	0.00	1.50	4.50	10.00	<i>Pinus edulis</i>
85.00	15.00	0.00	12.50	25.12	40.00	<i>Pinus ponderosa</i>
0.00	0.00	0.00	3.50	10.50	10.00	<i>Pseudotsuga menziesii</i>
						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	0.10	0.30	10.00	<i>Chrysothamnus nauseosus</i>
0.00	0.00	0.00	0.80	1.66	20.00	<i>Juniperus scopulorum</i>
0.00	0.00	0.00	2.30	3.20	50.00	<i>Mahonia repens</i>
0.00	0.00	5.00	0.50	1.50	10.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Symporicarpos oreophilus</i>
						FORBS
0.00	5.00	10.00	2.00	3.32	30.00	<i>Solidago sp.</i>
						GRASSES
5.00	40.00	20.00	13.00	11.22	100.00	<i>Elymus salinus</i>
0.00	0.00	0.00	0.80	2.40	10.00	<i>Stipa hymenoides</i>

						COVER
85.00	15.00	0.00	20.00	30.82		Overstory
5.00	45.00	35.00	20.00	13.04		Understory
85.00	45.00	40.00	52.40	21.65		Litter
5.00	5.00	15.00	7.60	3.85		Bareground
5.00	5.00	10.00	20.00	20.37		Rock
						% COMPOSITION
0.00	0.00	14.29	21.95	25.10		Shrubs
0.00	11.11	28.57	8.97	16.23		Forbs
100.00	88.89	57.14	69.08	24.12		Grasses
90.00	60.00	35.00	40.00	26.27		Overstory + Understory

GENWAL COAL
Crandall Canyon Mine
Topsoil Pile #2
Exposure: S & E
Slope: 5 - 25 deg.

Sample Date: 18 July 01 1.00 2.00 3.00 4.00 5.00 6.00 7.00

TREES & SHRUBS

<i>Rosa woodsii</i>	0.00	0.00	0.00	0.00	0.00	0.00	25.00
---------------------	------	------	------	------	------	------	-------

FORBS

GRASSES

<i>Agropyron cristatum</i>	70.00	0.00	0.00	5.00	20.00	5.00	0.00
<i>Bromus carinatus</i>	0.00	60.00	25.00	40.00	40.00	65.00	45.00
<i>Elymus trachycaulus</i>	0.00	0.00	15.00	0.00	0.00	0.00	0.00
<i>Elymus smithii</i>	0.00	0.00	10.00	0.00	5.00	5.00	0.00

COVER

Total Living Cover	70.00	60.00	50.00	45.00	65.00	75.00	70.00
Litter	20.00	20.00	20.00	5.00	25.00	15.00	19.00
Bareground	5.00	5.00	10.00	10.00	5.00	5.00	1.00
Rock	5.00	15.00	20.00	40.00	5.00	5.00	10.00

% COMPOSITION

Shrubs	0.00	0.00	0.00	0.00	0.00	0.00	35.71
Forbs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grasses	100.00	100.00	100.00	100.00	100.00	100.00	64.29

GENWAL COAL
Crandall Canyon Mine
Topsoil Pile #2
Exposure: S & E
Slope: 5 - 25 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

0.00 20.00 0.00 4.50 9.07 20.00 TREES & SHRUBS

Rosa woodsii

FORBS

GRASSES

55.00	5.00	30.00	19.00	23.85	70.00	<i>Agropyron cristatum</i>
10.00	55.00	30.00	37.00	20.02	90.00	<i>Bromus carinatus</i>
0.00	5.00	0.00	2.00	4.58	20.00	<i>Elymus trachycaulus</i>
0.00	5.00	5.00	3.00	3.32	50.00	<i>Elymus smithii</i>

COVER

65.00	70.00	65.00	63.50	8.96	Total Living Cover
30.00	20.00	33.00	20.70	7.35	Litter
4.00	9.00	1.00	5.50	3.11	Bareground
1.00	1.00	1.00	10.30	11.58	Rock

% COMPOSITION

0.00	28.57	0.00	6.43	12.96	Shrubs
0.00	0.00	0.00	0.00	0.00	Forbs
100.00	100.00	100.00	96.43	10.71	Grasses

GENWAL COAL

Crandall Canyon Mine

Native Comparison #2

Mountain Brush Community

Exposure: S & SW

Slope: 30 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

OVERSTORY

<i>Cercocarpus ledifolius</i>	0.00	0.00	25.00	5.00	0.00	0.00	0.00
-------------------------------	------	------	-------	------	------	------	------

UNDERSTORY

SHRUBS

<i>Cercocarpus ledifolius</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00
-------------------------------	------	------	------	------	------	------	------

<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00
-----------------------------	------	------	------	------	------	------	------

<i>Mahonia repens</i>	0.00	0.00	0.00	0.00	10.00	10.00	0.00
-----------------------	------	------	------	------	-------	-------	------

FORBS

<i>Artemisia ludoviciana</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
------------------------------	------	------	------	------	------	------	------

<i>Cirsium sp.</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
--------------------	------	------	------	------	------	------	------

GRASSES

<i>Elymus salinus</i>	25.00	5.00	0.00	25.00	25.00	30.00	40.00
-----------------------	-------	------	------	-------	-------	-------	-------

<i>Elymus spicatus</i>	0.00	10.00	30.00	0.00	0.00	0.00	0.00
------------------------	------	-------	-------	------	------	------	------

<i>Stipa hymenoides</i>	0.00	10.00	0.00	0.00	0.00	0.00	0.00
-------------------------	------	-------	------	------	------	------	------

COVER

Overstory	0.00	0.00	25.00	5.00	0.00	0.00	0.00
-----------	------	------	-------	------	------	------	------

Understory	25.00	25.00	40.00	25.00	35.00	50.00	40.00
------------	-------	-------	-------	-------	-------	-------	-------

Litter	5.00	5.00	10.00	10.00	45.00	30.00	45.00
--------	------	------	-------	-------	-------	-------	-------

Bareground	45.00	50.00	40.00	55.00	5.00	5.00	5.00
------------	-------	-------	-------	-------	------	------	------

Rock	25.00	20.00	10.00	10.00	15.00	15.00	10.00
------	-------	-------	-------	-------	-------	-------	-------

% COMPOSITION

Shrubs	0.00	0.00	0.00	0.00	28.57	40.00	0.00
--------	------	------	------	------	-------	-------	------

Forbs	0.00	0.00	25.00	0.00	0.00	0.00	0.00
-------	------	------	-------	------	------	------	------

Grasses	100.00	100.00	75.00	100.00	71.43	60.00	100.00
---------	--------	--------	-------	--------	-------	-------	--------

Overstory + Understory	25.00	25.00	65.00	30.00	35.00	50.00	40.00
------------------------	-------	-------	-------	-------	-------	-------	-------

GENWAL COAL
 Crandall Canyon Mine
 Native Comparison #2
 Mountain Brush Community
 Exposure: S & SW
 Slope: 30 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

0.00 0.00 0.00 3.00 7.48 20.00 OVERSTORY
Cercocarpus ledifolius

0.00 0.00 0.00 0.50 1.50 10.00 UNDERSTORY
 SHRUBS
Cercocarpus ledifolius
Juniperus scopulorum
Mahonia repens

5.00 0.00 0.00 1.00 2.00 20.00 FORBS
 0.00 0.00 0.00 0.50 1.50 10.00 *Artemisia ludoviciana*
Cirsium sp.

30.00 10.00 20.00 21.00 11.79 90.00 GRASSES
 0.00 5.00 0.00 4.50 9.07 40.00 *Elymus salinus*
 15.00 10.00 20.00 5.50 7.23 30.00 *Elymus spicatus*
Stipa hymenoides

0.00 0.00 0.00 3.00 7.48 COVER
 55.00 25.00 40.00 36.00 10.44
 5.00 10.00 5.00 17.00 15.68
 30.00 55.00 45.00 33.50 19.88
 10.00 10.00 10.00 13.50 5.02
 Litter
 Bareground
 Rock

9.09 0.00 0.00 7.77 13.77 % COMPOSITION
 9.09 0.00 0.00 3.41 7.69
 81.82 100.00 100.00 88.82 14.57
 Shrubs
 Forbs
 Grasses
 Overstory + Understory

GENWAL COAL

Crandall Canyon Mine

Topsoil Pile #3

Exposure: S & E

Slope: 5-25 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

TREES & SHRUBS

<i>Artemisia tridentata</i>	0.00	5.00	0.00	0.00	0.00	35.00	5.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	10.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FORBS

<i>Aster glaucodes</i>	0.00	15.00	0.00	0.00	0.00	0.00	0.00
<i>Cirsium</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00

GRASSES

<i>Agropyron cristatum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus junceus</i>	35.00	40.00	55.00	50.00	5.00	15.00	45.00
<i>Elymus smithii</i>	0.00	0.00	0.00	0.00	55.00	0.00	0.00
<i>Elymus trachycaulus</i>	0.00	5.00	0.00	5.00	0.00	5.00	0.00
<i>Poa secunda</i>	0.00	0.00	0.00	10.00	0.00	0.00	0.00

COVER

Total Living Cover	35.00	65.00	55.00	65.00	60.00	65.00	60.00
Litter	10.00	20.00	20.00	15.00	10.00	25.00	25.00
Bareground	35.00	10.00	10.00	5.00	15.00	5.00	5.00
Rock	20.00	5.00	15.00	15.00	15.00	5.00	10.00

% COMPOSITION

Shrubs	0.00	7.69	0.00	0.00	0.00	69.23	8.33
Forbs	0.00	23.08	0.00	0.00	0.00	0.00	16.67
Grasses	100.00	69.23	100.00	100.00	100.00	30.77	75.00

GENWAL COAL
 Crandall Canyon Mine
 Topsoil Pile #3
 Exposure: S & E
 Slope: 5-25 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

TREES & SHRUBS

0.00	0.00	0.00	4.50	10.36	30.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	1.00	3.00	10.00	<i>Juniperus scopulorum</i>
0.00	10.00	0.00	1.00	3.00	10.00	<i>Symporicarpos oreophilus</i>

FORBS

0.00	0.00	0.00	1.50	4.50	10.00	<i>Aster glaucodes</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Cirsium</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Cynoglossum officinale</i>

GRASSES

5.00	15.00	0.00	2.00	4.58	20.00	<i>Agropyron cristatum</i>
55.00	35.00	50.00	38.50	15.98	100.00	<i>Elymus junceus</i>
0.00	10.00	5.00	7.00	16.31	30.00	<i>Elymus smithii</i>
5.00	0.00	0.00	2.00	2.45	40.00	<i>Elymus trachycaulus</i>
0.00	0.00	0.00	1.00	3.00	10.00	<i>Poa secunda</i>

COVER

65.00	70.00	55.00	59.50	9.34	Total Living Cover
15.00	15.00	10.00	16.50	5.50	Litter
10.00	5.00	15.00	11.50	8.67	Bareground
10.00	10.00	20.00	12.50	5.12	Rock

% COMPOSITION

0.00	14.29	0.00	9.95	20.33	Shrubs
0.00	0.00	0.00	3.97	8.08	Forbs
100.00	85.71	100.00	86.07	21.51	Grasses

GENWAL COAL

Crandall Canyon Mine
 Native Comparison #3/4
 Mountain Brush/ PJ Transition
 Exposure: S SE
 Slope: 25 deg.
 Sample Date: 18 July 01

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
<i>Juniperus scopulorum</i>	0.00	15.00	0.00	0.00	0.00	0.00	40.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
<i>Artemisia tridentata</i>	3.00	20.00	0.00	0.00	25.00	0.00	5.00
<i>Chrysothamnus nauseosus</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Mahonia repens</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Opuntia polyacantha</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	10.00	0.00	0.00	0.00	0.00	0.00
FORBS							
<i>Aster foliaceus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Machaeranthera canescens</i>	2.00	0.00	2.00	0.00	0.00	0.00	0.00
<i>Penstemon sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
<i>Elymus salinus</i>	0.00	20.00	2.00	15.00	0.00	25.00	0.00
<i>Elymus spicatus</i>	0.00	0.00	0.00	0.00	15.00	0.00	5.00
<i>Poa secunda</i>	5.00	0.00	1.00	0.00	0.00	0.00	0.00
<i>Stipa hymenoides</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Overstory	0.00	15.00	0.00	0.00	0.00	0.00	40.00
Understory	20.00	50.00	10.00	20.00	40.00	25.00	10.00
Litter	5.00	5.00	1.00	5.00	10.00	10.00	25.00
Bareground	35.00	40.00	65.00	40.00	15.00	40.00	5.00
Rock	40.00	5.00	24.00	35.00	35.00	25.00	60.00
% COMPOSITION							
Shrubs	40.00	60.00	50.00	25.00	62.50	0.00	50.00
Forbs	10.00	0.00	20.00	0.00	0.00	0.00	0.00
Grasses	50.00	40.00	30.00	75.00	37.50	100.00	50.00
Overstory + Understory	20.00	65.00	10.00	20.00	40.00	25.00	50.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	Mean	SDev
0.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	12.94
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.25
80.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.33	19.96
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.53	7.62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.25
0.00	0.00	0.00	33.00	0.00	0.00	0.00	0.00	2.20	8.23
0.00	0.00	0.00	0.00	0.00	10.00	15.00	2.00	2.13	4.36
0.00	0.00	3.00	0.00	5.00	0.00	0.00	0.00	0.53	1.41
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	1.00	2.71
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.33	1.25
0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.60	1.36
0.00	0.00	2.00	2.00	0.00	0.00	0.00	0.00	0.27	0.68
1.00	0.00	10.00	0.00	0.00	0.00	15.00	13.00	6.73	8.44
0.00	0.00	0.00	0.00	5.00	15.00	0.00	5.00	3.00	5.10
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.73	1.69
0.00	10.00	0.00	10.00	20.00	0.00	0.00	0.00	3.00	5.72
80.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	11.67	22.78
1.00	10.00	15.00	50.00	35.00	25.00	40.00	20.00	24.73	14.66
65.00	55.00	70.00	10.00	5.00	5.00	5.00	20.00	19.73	22.78
4.00	5.00	10.00	20.00	35.00	5.00	5.00	10.00	22.27	18.22
30.00	30.00	5.00	20.00	25.00	65.00	50.00	50.00	33.27	17.03
0.00	0.00	20.00	66.00	14.29	40.00	50.00	10.00	32.52	23.14
0.00	0.00	13.33	14.00	14.29	0.00	0.00	0.00	4.77	7.00
100.00	100.00	66.67	20.00	71.43	60.00	50.00	90.00	62.71	25.42
81.00	50.00	15.00	50.00	35.00	25.00	40.00	20.00	36.40	19.34

GENWAL COAL
Crandall Canyon Mine
Native Comparison #3/4
Mountain Brush/ PJ Transition
Exposure: S SE
Slope: 25 deg.
Freq Sample Date: 18 July 01

OVERSTORY	
20.00	<i>Juniperus scopulorum</i>
6.67	<i>Pinus edulis</i>
6.67	<i>Pseudotsuga menziesii</i>

UNDERSTORY

SHRUBS

26.67	<i>Artemisia tridentata</i>
6.67	<i>Chrysothamnus nauseosus</i>
6.67	<i>Gutierrezia sarothrae</i>
6.67	<i>Juniperus scopulorum</i>
26.67	<i>Mahonia repens</i>
13.33	<i>Opuntia polyacantha</i>
13.33	<i>Symporicarpos oreophilus</i>

FORBS

6.67	<i>Aster foliaceous</i>
20.00	<i>Machaeranthera canescens</i>
13.33	<i>Penstemon sp.</i>

GRASSES

53.33	<i>Elymus salinus</i>
33.33	<i>Elymus spicatus</i>
20.00	<i>Poa secunda</i>
26.67	<i>Stipa hymenoides</i>

COVER

Overstory

Understory

Litter

Bareground

Rock

% COMPOSITION

Shrubs

Forbs

Grasses

Overstory + Understory

GENWAL COAL

Crandall Canyon Mine

Topsoil Pile #4

Exposure: N & S

Slope: ~ 20 deg.

Sample Date: 18 July 01

1.00 2.00 3.00 4.00 5.00 6.00 7.00

TREES & SHRUBS

<i>Ribes aureum</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Rosa woodsii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00

FORBS

<i>Achillea millefolium</i>	30.00	10.00	10.00	0.00	0.00	0.00	5.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Linum Lewisii</i>	5.00	25.00	5.00	20.00	15.00	10.00	10.00
<i>Medicago sativa</i>	0.00	10.00	15.00	10.00	10.00	30.00	15.00
<i>Penstemon sp.</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00

GRASSES

<i>Agropyron cristatum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Bromus carinatus</i>	0.00	0.00	0.00	5.00	10.00	0.00	0.00
<i>Dactylis glomeratus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus cinereus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus smithii</i>	10.00	5.00	0.00	0.00	10.00	5.00	0.00
<i>Elymus spicatus</i>	5.00	5.00	35.00	30.00	0.00	5.00	10.00

COVER

Total Living Cover	60.00	55.00	65.00	65.00	50.00	50.00	40.00
Litter	5.00	5.00	3.00	5.00	5.00	5.00	15.00
Bareground	20.00	30.00	12.00	15.00	25.00	20.00	30.00
Rock	15.00	10.00	20.00	15.00	20.00	25.00	15.00

% COMPOSITION

Shrubs	16.67	0.00	0.00	0.00	0.00	0.00	0.00
Forbs	58.33	81.82	46.15	46.15	60.00	80.00	75.00
Grasses	25.00	18.18	53.85	53.85	40.00	20.00	25.00

GENWAL COAL
 Crandall Canyon Mine
 Topsoil Pile #4
 Exposure: N & S
 Slope: ~ 20 deg.

8.00 9.00 10.00 Mean SDev Freq Sample Date: 18 July 01

						TREES & SHRUBS
0.00	0.00	0.00	0.50	1.50	10.00	<i>Ribes aureum</i>
0.00	0.00	5.00	0.50	1.50	10.00	<i>Rosa woodsii</i>
0.00	0.00	5.00	1.00	2.00	20.00	<i>Symphoricarpos oreophilus</i>

						FORBS
5.00	10.00	25.00	9.50	9.86	70.00	<i>Achillea millefolium</i>
0.00	0.00	5.00	0.50	1.50	10.00	<i>Cynoglossum officinale</i>
10.00	15.00	0.00	11.50	7.09	90.00	<i>Linum Lewisii</i>
20.00	0.00	5.00	11.50	8.67	80.00	<i>Medicago sativa</i>
5.00	0.00	0.00	1.00	2.00	20.00	<i>Penstemon sp.</i>

						GRASSES
0.00	5.00	0.00	0.50	1.50	10.00	<i>Agropyron cristatum</i>
0.00	10.00	0.00	2.50	4.03	30.00	<i>Bromus carinatus</i>
0.00	10.00	10.00	2.00	4.00	20.00	<i>Dactylis glomeratus</i>
0.00	0.00	10.00	1.00	3.00	10.00	<i>Elymus cinereus</i>
5.00	5.00	5.00	4.50	3.50	70.00	<i>Elymus smithii</i>
0.00	0.00	0.00	9.00	12.21	60.00	<i>Elymus spicatus</i>

						COVER
45.00	55.00	70.00	55.50	9.07		Total Living Cover
10.00	10.00	5.00	6.80	3.49		Litter
20.00	15.00	10.00	19.70	6.62		Bareground
25.00	20.00	15.00	18.00	4.58		Rock

						% COMPOSITION
0.00	0.00	14.29	3.10	6.21		Shrubs
88.89	45.45	50.00	63.18	15.91		Forbs
11.11	54.55	35.71	33.72	15.43		Grasses

APPENDIX C

Legal Financial, Compliance and Related Information

Annual Report of Officers
As submitted to the Utah Department of Commerce

Other change in ownership and control information
As required under R645-301-110

CONTENTS

Department of Commerce Annual Report



State Online Services

Agency List

Search Utah.gov

go



business entity search

Utah Department of
Commercereturn to business
entity search

Name	Type	City	Status
GENWAL RESOURCES, INC.	Corporation	SALT LAKE CITY UT	Active

Principal Information

Position	Name	Address		
Director	PETER B GREEN	45 W 10000 S STE 401	SANDY	UT 84070
Director	DOUGLAS H SMITH	45 W 10000 S STE 401	SANDY	UT 84070
Director	RONALD C BEEDIE	45 W 10000 S STE 401	SANDY	UT 84070
President	DOUGLAS H SMITH	45 W 10000 S STE 401	SANDY	UT 84070
Registered Agent	JOHN S KIRKHAM	201 S MAIN STE 1100	SALT LAKE CITY	UT 841114904
Secretary	C JOHN BRADSHAW	45 W 10000 S STE 401	SANDY	UT 84070
Treasurer	C JOHN BRADSHAW	45 W 10000 S STE 401	SANDY	UT 84070
Vice President	SAMUEL C QUIGLEY	45 W 10000 S STE 401	SANDY	UT 84070

Additional Principals on file at Division of
Corporations: N

[Cancel](#)[Do Another Search](#)

APPENDIX D

Mine Maps

As required under R645-302-525-270

CONTENTS

Mine Map with Production Areas

APPENDIX E

Other Information

In accordance with the requirements of R645-301 and R645-302

CONTENTS

None